United States Department of Agriculture

Land Management Plan for the Apache-Sitgreaves National Forests

Apache, Coconino, Greenlee, and Navajo Counties, Arizona

Forest Service Apache-Sitgreaves National Forests MB-R3-01-10 August 2015
Slightly Revised October 2016

Printed on recycled paper – August 2015; Slightly Revised October 2016 to include Administrative Changes 1-3.

Land Management Plan for the Apache-Sitgreaves National Forests

Apache, Coconino, Greenlee, and Navajo Counties, Arizona

Contents

Commonly Used Acronyms ix

Chapter 1. Background 1
- Introduction 1
- Purpose of this Land Management Plan 1
- Summary of the Analysis of the Management Situation 2
  - Maintenance and Improvement of Ecosystem Health 3
  - Managed Recreation 4
  - Community–Forest Interaction 4
- Plan Consistency 5
- Plan Content 5
  - Plan Decisions 5
  - Other Content 8
- Changes to the Plan 9
  - Administrative Changes 9
- Plan Organization 10
- Roles and Contributions of the Apache-Sitgreaves NFs 11
  - The Apache-Sitgreaves NFs Mission 13
  - The Apache-Sitgreaves NFs Vision 13

Chapter 2. Forestwide Direction 15
- Introduction 15
- Maintenance and Improvement of Ecosystem Health 15
  - Overall Ecosystem Health 15
  - Air 18
  - Soil 20
  - Water Resources 22
  - Aquatic Habitat and Species 25
  - All PNVTs 27
  - Riparian Areas 31
  - Forests: All Forested PNVTs 37
  - Forests: Ponderosa Pine 40
  - Forests: Dry Mixed Conifer 42
  - Forests: Wet Mixed Conifer 45
  - Forests: Spruce-Fir 47
  - Forests: Aspen 49
  - Woodlands: All Woodland PNVTs 52
  - Woodlands: Madrean Pine-Oak 53
  - Woodlands: Piñon-Juniper 55
  - Grasslands 56
  - Interior Chaparral 59
  - Wildlife and Rare Plants 61
  - Invasive Species 65
  - Landscape Scale Disturbance Events 67
- Managed Recreation 69
  - Overall Recreation Opportunities 69
  - Dispersed Recreation 71
  - Developed Recreation 73
  - Motorized Opportunities 75
  - Nonmotorized Opportunities 78
  - Scenic Byways 79
  - National Recreation Trails 80
  - Eligible and Suitable Wild and Scenic Rivers 82
  - Scenic Resources 84
- Community-Forest Interaction 86

Conservation Education ... 87
Lands ... 88
Cultural Resources ... 89
American Indian Rights and Interests ... 92
Forest Products ... 94
Livestock Grazing ... 96
Minerals and Geology ... 98
Special Uses ... 101
Water Uses ... 103
Wildland Fire Management ... 105

Chapter 3. Management Area Direction ... 111
General Forest ... 112
Community-Forest Intermix ... 112
High Use Developed Recreation Area ... 115
Energy Corridor ... 116
Wild Horse Territory ... 118
Wildlife Quiet Area ... 119
Natural Landscape ... 121
Research Natural Area ... 122
Recommended Research Natural Area ... 123
Wilderness ... 126
Primitive Area ... 128
Recommended Wilderness ... 130

Chapter 4. Suitability ... 133
Introduction to Suitability ... 133
Livestock Grazing Suitability ... 133
Special Uses Suitability ... 134
Lands Suitable for Timber Production ... 135
Motorized Uses Suitability ... 137
Recreation Suitability ... 139

Chapter 5. Monitoring Strategy ... 141
Introduction ... 141
Monitoring Strategy ... 141

List of Preparers ... 147
Team Members ... 147

Glossary ... 149

References ... 173

Appendix A. Climate Change Trends and Apache-Sitgreaves NFs Land Management Planning ... 179
Overview and Background ... 179
Climate in the American Southwest and the Apache-Sitgreaves NFs ... 179
Southwestern Climate Change and Apache-Sitgreaves NFs Ecosystems ... 184
Southwestern Climate Change and Socioeconomic Effects ... 193
Key Climate Change Factors for the Apache-Sitgreaves NFs ... 197
Potential Climate Change Strategies for the Apache-Sitgreaves NFs ... 200
Climate Change Glossary ... 204
References ... 207
Specific Web Sites: ... 213

Appendix B. Vegetation Conditions and Management Practices ... 215

Forestwide Vegetation Conditions ... 215
Age Classes Typically Occurring on the Apache-Sitgreaves NFs ... 240
Old Growth in the Southwestern Region of the Forest Service ... 242
Vegetation Management Practices ... 243
References ... 246

Appendix C. Communications Sites ... 249

Appendix D. Relevant Laws, Regulations, Policies, and Other Sources of Information ... 251
Forest Service Directives ... 251
Federal Statutes ... 254
American Indian Religious Freedom Act (AIRFA) as amended (42 USC 1996) ... 254
Americans with Disabilities Act of 1990 ... 255
Anderson-Mansfield Reforestation and Revegetation Act of October 11, 1949 ... 255
Antiquities Act of 1906 (16 USC 431- 433) ... 255
Archaeological and Historic Preservation Act of 1974 (AHPA) (16 USC 469) ... 255
Archaeological Resources Protection Act of 1979 as amended (ARPA) (16 USC 470 aa et seq.) ... 255
Architectural Barriers Act of 1968 ... 256
Bald and Golden Eagle Protection Act of 1940, as amended ... 256
Bankhead-Jones Farm Tenant Act of July 22, 1937 ... 256
Clarke-McNary Act of June 7, 1924 ... 256
Clean Air Act of August 7, 1977, as amended (1977 and 1990) ... 256
Clean Water Act (see Federal Water Pollution Control Act) ... 257
Common Varieties of Mineral Materials Act of July 31, 1947 ... 257
Cooperative Forestry Assistance Act of July 1, 1978 ... 257
Economy Act of June 30, 1932 ... 257
Emergency Flood Prevention (Agricultural Credit Act) Act of August 4, 1978 ... 257
Endangered Species Act of 1973, as amended ... 257
Energy Policy Act of 2005 ... 258
Energy Security Act of June 30, 1980 ... 258
Federal Advisory Committee Act of October 6, 1972 ... 258
Federal Cave Resources Protection Act of November 18, 1988 ... 258
Federal Insecticide, Rodenticide, and Fungicide Act of October 21, 1972 ... 258
Federal Land Policy and Management Act of October 21, 1976 ... 259
Federal Noxious Weed Act, 1974, as amended ... 259
Federal Power Act of June 10, 1920 ... 259
Federal-State Cooperation for Soil Conservation Act of December 22, 1944 ... 259
Federal Water Pollution Control Act and Amendments of 1972 (Clean Water Act) ... 259
Federal Water Project Recreation Act of July 9, 1965 ... 260
Fish and Wildlife Conservation Act of September 15, 1960 ... 260
Fish and Wildlife Coordination Act of March 10, 1934 ... 260
Food, Conservation and Energy Act of 2008 (2008 Farm Bill) Public Law 110-246 Title VIII – Forestry, Subtitle A, B, and C ... 260
Forest Highways Act of August 27, 1958 ... 260
Forest and Rangeland Renewable Resources Planning Act of August 17, 1974 ... 261
Freedom of Information Act of November 21, 1974 ... 261
Geothermal Steam Act of December 24, 1970 ... 261
Granger-Thye Act of April 24, 1950 ... 261
Healthy Forests Restoration Act of 2003 (H.R. 1904) ... 261
Historic Sites Act of 1935 (16 USC 461) ... 262
Intergovernmental Cooperation Act of October 16, 1968 (31 USC 6505) ... 262
Joint Surveys of Watershed Areas Act of September 5, 1962 ... 262
Knutson-Vandenberg Act of June 9, 1930 ... 262
Land Acquisition Act of March 3, 1925 ... 262
Land Acquisition – Title Adjustment Act of July 8, 1943 ... 262

Land and Water Conservation Fund Act of September 3, 1964 262
Law Enforcement Authority Act of March 3, 1905 263
Leases Around Reservoirs Act of March 3, 1962 263
Migratory Bird Treaty Act of 1918 263
Mineral Leasing Act of February 25, 1920 263
Mineral Leasing Act for Acquired Lands Act of August 7, 1947 263
Mineral Resources on Weeks Law Lands Act of March 4, 1917 263
Mineral Springs Leasing Act of February 28, 1899 263
Mining Claims Rights Restoration Act of August 11, 1955 263
Mining and Minerals Policy Act of December 31, 1970 264
Multiple Use–Sustained Yield Act of June 12, 1960 264
National Environmental Education Act of November 16, 1970 264
National Environmental Policy Act of January 1, 1970 264
National 1990 Farm Bill (title XII – Forest Stewardship Act) Act of November 28, 1990 264
National Forest Management Act of October 22, 1976 264
National Forest Roads and Trails Act of October 13, 1964 265
National Historic Preservation Act of 1966 as amended (NHPA) (16 USC 470) 265
National Forest System Land and Resource Management Plans (16 U.S.C 1604) 265
National Trails System Act of October 2, 1968 265
Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (25 USC 3001) 265
Occupancy Permits Act of March 4, 1915 266
Oil and Gas Leasing Reform Act of 1987 266
Organic Administration Act of June 4, 1897 266
Petrified Wood Act of September 28, 1962 266
Pipelines Act of February 25, 1920 266
Public Buildings Cooperative Use Act of 1976 266
Public Land Surveys Act of March 3, 1899 267
Public Rangelands Improvement Act of October 25, 1978 267
Rescission Act of 1995 267
Rehabilitation Act of 1973, as amended 267
Religious Freedom Restoration Act (RIFRA) (42 USC § 2000bb) 267
Renewable Resources Extension Act of June 30, 1978 268
Research Grants Act of September 6, 1958 268
Rural Development Act of August 30, 1972 268
Safe Drinking Water Amendments of November 18, 1977 268
Secure Rural Schools and Community Self-Determination Act of 2000 268
Sikes Act of October 18, 1974, as amended 268
Small Tracts Act of January 22, 1983 268
Smokey Bear Act of May 23, 1952 269
Soil and Water Resources Conservation Act of November 18, 1977 269
Solid Waste Disposal Act (Resource Conservation and Recovery Act) of October 21, 1976 269
Supplemental National Forest Reforestation Fund Act of September 18, 1972 269
Surface Mining Control and Reclamation Act of August 3, 1977 269
Sustained Yield Forest Management Act of March 29, 1944 269
Timber Export Act of March 4, 1917 269
Timber Exportation Act of April 12, 1926 270
Title Adjustment Act of April 28, 1930 270
Toxic Substances Control Act of October 11, 1976 270
Transfer Act of February 1, 1905 270
Tribal Forest Protection Act of 2004 (Public Law 108-278) 270
Twenty-Five Percent Fund Act of May 23, 1908 270
Uniform Federal Accessibility Standards U.S. Criminal Code (Title 18 USC Chapter 91 – Public Lands) Act of June 25, 1948 270
U.S. Mining Laws (Public Domain Lands) Act of May 10, 1872 270

Volunteers in the National Forests Act of May 18, 1972 271
Water Quality Improvement Act of April 3, 1970 271
Water Resources Planning Act of July 22, 1965 271
Watershed Protection and Flood Prevention Act of August 4, 1954 271
Weeks Act Status for Certain Lands Act of September 2, 1958 271
Wild Free-Roaming Horses and Burros Act of December 15, 1971, as amended by Federal Land Policy Management Act of 1976 and Public Rangelands Improvement Act of 1978 272
Wild and Scenic Rivers Act of October 2, 1968 272
Wilderness Act of September 3, 1964 272
Wildlife Game Refuges Act of August 11, 1916 272
Wood Residue Utilization Act of December 19, 1980 272
Woodsy Owl/Smokey Bear Act of June 22, 1974 272
Youth Conservation Corps Act of August 13, 1970 273
Regulations 273
33 CFR § 323 Permits for Discharges of Dredged or Fill Material into Waters of the United States . 273
36 CFR § 60 National Register of Historic Places 273
36 CFR § 61 Procedures for Approved State and Local Government Historic Preservation Programs 273
36 CFR § 63 Determinations of Eligibility for Inclusion in the National Register of Historic Places 273
36 CFR § 65 National Historic Landmarks Program 273
36 CFR § 68 The Secretary of the Interior’s Standards for Historic Properties 273
36 CFR § 79 Curation of Federally Owned and Administered Archaeological Collections 274
36 CFR § 212 Forest Development Transportation System 274
36 CFR § 219 Planning 274
36 CFR § 221 Timber Management Planning 274
36 CFR § 222 Range Management 274
36 CFR § 223 Sale and Disposal of National Forest System Timber 274
36 CFR § 228 Minerals 274
36 CFR § 241 Fish and Wildlife 274
36 CFR § 251 Land Uses 274
36 CFR § 254 Landownership Adjustments 274
36 CFR § 261 Prohibitions 275
36 CFR § 291 Occupancy and Use of Developed Sites and Areas of Concentrated Public Use 275
36 CFR § 292 National Recreation Areas 275
36 CFR § 293 Wilderness-Primitive Areas 275
36 CFR § 294 Special Areas 275
36 CFR § 295 Use of Motor Vehicles Off Forest Development Roads 275
36 CFR § 296 Protection of Archaeological Resources: Uniform Regulations 275
36 CFR § 297 Wild and Scenic Rivers 275
36 CFR § 800 Protection of Historic Properties 275
40 CFR § 121-135 Water Programs 276
40 CFR § 1500 Council on Environmental Quality 276
43 CFR § 3 Preservation of American Antiquities 276
43 CFR § 10 Native American Graves Protection and Repatriation Act Regulations 276
50 CFR § 402 Regulations Governing Interagency Cooperation—Endangered Species Act of 1973, as amended 276
Executive Orders 276
E.O. 11593 Protection and Enhancement of the Cultural Environment, 1973 276
E.O. 11644 (amended by E.O. 11989) Use of Off-Road Vehicles, 1972, 1977 277
E.O. 11988 Floodplain Management, 1977 277
E.O. 11990 Protection of Wetlands, 1977 277
E.O. 12088 Federal Compliance with Pollution Control Standards (Amended by E.O. 12580), 1978, 1987 277
E.O. 12372 Intergovernmental Review of Federal Programs, 1982 277

E.O. 12862 Setting Customer Service Standards, 1993 ... 278
E.O. 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994 ... 278
E.O. 13007 Indian Sacred Sites, 1996 ... 278
E.O. 13112 Invasive Species, 1999 ... 278
E.O. 13175 Consultation and Coordination with Indian Tribal Governments, 2000 ... 278
E.O. 13186 Responsibilities of Federal Agencies to Protect Migratory Birds, 2001 ... 279
E.O. 13195 Trails for America in the 21st Century, 2001 ... 279
E.O. 13287 Preserve America, 2003 ... 279
E.O. 13352 Facilitation of Cooperative Conservation, 2004 ... 279
E.O. 13433 Facilitation of Hunting Heritage and Wildlife Conservation, 2007 ... 279
State Regulations ... 279
Other Sources of Information ... 280

Appendix E. Proposed and Possible Management Actions ... 289
Introduction ... 289
Proposed Management Actions ... 289
Possible Management Actions ... 291
Overall Ecosystem Health ... 291
Air ... 292
Soil ... 292
Water Resources ... 292
Aquatic Habitat and Species ... 292
Vegetation Management ... 292
Riparian Areas ... 292
Wildlife and Rare Plants ... 293
Invasive Species ... 293
Landscape Scale Disturbance Events ... 293
Developed and Dispersed Recreation ... 294
Motorized and Nonmotorized Opportunities ... 294
Scenic Byways ... 294
Eligible and Suitable Wild and Scenic Rivers ... 294
Conservation Education ... 295
Lands ... 295
Cultural Resources ... 295
American Indian Rights and Interests ... 295
Forest Products ... 295
Livestock Grazing ... 295
Minerals and Geology ... 296
Special Uses ... 296
Water Uses ... 296
Wildland Fire Management ... 296
Management Areas ... 297

Appendix F. Maps ... 299

Index ... 303

List of Figures

Figure 1. The Apache-Sitgreaves NFs and adjacent landowners ... 2
Figure 2. Fall colors, Apache-Sitgreaves NFs ... 11
Figure 3. Blue River ... 22
Figure 4. Prescribed fire ... 39
Figure 5. Ecological diversity provided by a healthy, mature aspen stand ... 50
Figure 6. Golden-crowned kinglet ... 61
Figure 7. Yellow toadflax, an invasive species on the Apache-Sitgreaves NFs ... 65
Figure 8. Woods Canyon Lake ... 74
Figure 9. Small diameter trees to be used for forest products ... 96
Figure 10. Treated area within the CFI that survived the 2011 Wallow Fire ... 114
Figure 11. East Fork of the Little Colorado River in Mount Baldy Wilderness ... 126
Figure 12. A forest user rides along the Saffel Canyon OHV Trail ... 137
Figure 13. Wetland/Cienega Riparian Areas Woody Overstory Vegetation Condition ... 216
Figure 14. Wetland/Cienega Riparian Areas Herbaceous Understory Vegetation Condition 217
Figure 15. Montane Willow Riparian Forest Overstory Vegetation Condition ... 218
Figure 16. Montane Willow Riparian Forest Herbaceous Understory Vegetation Condition 219
Figure 17. Cottonwood-Willow Riparian Forest Overstory Vegetation Condition ... 220
Figure 18. Cottonwood-Willow Riparian Forest Herbaceous Understory Vegetation Condition ... 221
Figure 19. Mixed Broadleaf Deciduous Riparian Forest Overstory Vegetation Condition ... 221
Figure 20. Mixed Broadleaf Deciduous Riparian Forest Herbaceous Understory Vegetation Condition ... 222
Figure 21. Ponderosa Pine Forest Overstory Vegetation Condition ... 223
Figure 22. Ponderosa Pine Forest Herbaceous Understory Vegetation Condition ... 224
Figure 23. Dry Mixed Conifer Forest Overstory Vegetation Condition ... 225
Figure 24. Dry Mixed Conifer Forest Herbaceous Understory Vegetation Condition ... 226
Figure 25. Wet Mixed Conifer Forest Overstory Vegetation Condition ... 227
Figure 26. Wet Mixed Conifer Forest Herbaceous Understory Vegetation Condition ... 229
Figure 27. Spruce-Fir Forest Overstory Vegetation Condition ... 229
Figure 28. Spruce-Fir Forest Herbaceous Understory Vegetation Condition ... 231
Figure 29. Madrean Pine-Oak Woodland Overstory Vegetation Condition ... 232
Figure 30. Madrean Pine-Oak Woodland Herbaceous Understory Vegetation Condition ... 233
Figure 31. Piñon-Juniper Woodland Overstory Vegetation Condition ... 233
Figure 32. Piñon-Juniper Woodland Herbaceous Understory Vegetation Condition ... 234
Figure 33. Semi-desert Grassland Woody Overstory Vegetation Condition ... 235
Figure 34. Semi-desert Grassland Herbaceous Understory Vegetation Condition ... 236
Figure 35. Great Basin Grassland Woody Overstory Vegetation Condition ... 236
Figure 36. Great Basin Grassland Herbaceous Understory Vegetation Condition ... 237
Figure 37. Montane/Subalpine Grasslands Woody Overstory Vegetation Condition ... 238
Figure 38. Montane/Subalpine Grasslands Herbaceous Understory Vegetation Condition ... 239
Figure 39. Interior Chaparral Overstory Vegetation Condition ... 239
Figure 40. Interior Chaparral Herbaceous Understory Vegetation Condition ... 240
Figure 41. Keen’s tree classification for ponderosa pine ... 241
Figure 42. Hierarchy of management direction for national forests ... 251
Figure 43. Management Areas on the Apache-Sitgreaves NFs (Apache National Forest area) ... 301

Figure 44. Management Areas on the Apache-Sitgreaves NFs (Sitgreaves National Forest area) ... 302

List of Tables

Table 1. Eligible wild and scenic rivers of the Apache-Sitgreaves NFs by river classification[a] ... 82
Table 2. Suitable wild and scenic rivers of the Apache-Sitgreaves NFs by river classification ... 83
Table 3. Fire regimes by PNVTs on the Apache-Sitgreaves NFs... 106
Table 4. Management areas of the Apache-Sitgreaves NFs (acres of NFS land)... 111
Table 5. Areas recommended for wilderness ... 130
Table 6. Suitability of livestock grazing on the Apache-Sitgreaves NFs... 134
Table 7. Suitability of select special uses on the Apache-Sitgreaves NFs ... 134
Table 8. Suitability of lands for timber production and tree cutting ... 136
Table 9. Suitability of motorized travel on the Apache-Sitgreaves NFs ... 137
Table 10. Suitability for new designated motorized areas, NFS roads, NFS motorized trails, and temporary road construction on the Apache-Sitgreaves NFs ... 138
Table 11. Suitability for mechanized and nonmotorized travel on the Apache-Sitgreaves NFs ... 140
Table 12. Apache-Sitgreaves NFs land management plan monitoring questions, monitoring methods, and frequency of measurements ... 142
Table 13. Apache-Sitgreaves NFs' PNVTs and NFS acres ... 215
Table 14. Standard Vegetation Management Practices for Site-Specific Project Planning and Implementation ... 244
Table 15. Communications sites on the Apache-Sitgreaves National Forests ... 249
Table 16. List of proposed management actions (plan objectives) ... 289

Commonly Used Acronyms

ADEQ	Arizona Department of Environmental Quality
ADOT	Arizona Department of Transportation
ADWR	Arizona Department of Water Resources
AZGFD	Arizona Game and Fish Department
AMS	Analysis of the Management Situation
ASQ	Allowable Sale Quantity
BAER	Burned Area Emergency Response
BLM	Bureau of Land Management
BMP	Best Management Practice
CCF	100 Cubic Feet
CCVA	Climate Change Vulnerability Assessment
CER	Comprehensive Evaluation Report
CFI	Community-Forest Intermix
CFR	Code of Federal Regulations
CWPP	Community Wildfire Protection Plan
DBH	Diameter at Breast Height
DRC	Diameter at Root Collar
DMCF	Dry Mixed Conifer Forest
EI	Ecological Indicator
EPA	Environmental Protection Agency
EO	Executive Order
ERU	Ecological Response Unit
ESA	Endangered Species Act
FHA	Federal Highway Administration
FIA	Forest Inventory Analysis
FR	Federal Register
FSH	Forest Service Manual
FSM	Forest Service Handbook
GIS	Geographical Information System
GTR	General Technical Report
HUC	Hydrologic Unit Code
IRA	Inventoried Roadless Area
MIS	Management Indicator Species
MSO	Mexican Spotted Owl
MVUM	Motor Vehicle Use Map
NEPA	National Environmental Policy Act
NF	National Forest
NFMA	National Forest Management Act
NFS	National Forest System
NPS	Non-Point source
NRCS	Natural Resource Conservation Service
NRHP	National Register of Historic Places
NRT	National Recreation Trail
NVUM	National Visitor Use Monitoring
OHV	Off-Highway Vehicle
PAC	Protected Activity Center
PFA	Post-Fledging Family Area

PFC	Proper Functioning Condition
PNVT	Potential Natural Vegetation Type
RMRS	Rocky Mountain Research Station
RNA	Research Natural Area
ROS	Recreation Opportunity Spectrum
SAD	Sudden Aspen Decline
TCP	Traditional Cultural Property
TES	Terrestrial Ecosystem Survey
USC	United States Code
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
USFS	United States Forest Service
WQA	Wildlife Quiet Area
WUI	Wildland-Urban Interface

Chapter 1. Background

Introduction

The “Land Management Plan for the Apache-Sitgreaves National Forests” (hereinafter referred to as the plan or land management plan), covers the National Forest System (NFS) lands within the boundary of the Apache-Sitgreaves National Forests (Apache-Sitgreaves NFs or the forests).

The Apache-Sitgreaves National Forests’ 2.1 million acres[1] are managed as a single administrative unit by the Forest Service, an agency of the U.S. Department of Agriculture (USDA). The forests are located in the White Mountains of east-central Arizona (figure 1). The Gila National Forest administers the portion of the Apache National Forest located in New Mexico.

The forests are divided into five contiguous ranger districts: Black Mesa, Lakeside, Springerville, Alpine, and Clifton. Ranger district offices are located in Overgaard, Pinetop-Lakeside, Springerville, Alpine, and Clifton. The Supervisor’s Office is located in Springerville.

The forests share boundaries with the Gila, Coconino, and Tonto National Forests; Fort Apache and San Carlos Apache Indian Reservations; Bureau of Land Management; State land; several cities, towns, and communities; and private lands (figure 1).

The roles and contributions of the Apache-Sitgreaves NFs are described on page 11.

Purpose of this Land Management Plan

The planning process that was followed to create this plan aims to produce responsible land management for the Apache-Sitgreaves NFs based on useful and current information and guidance. The planning process used the provisions of the 1982 Planning Rule, as allowed per the transition language of the 2012 Planning Rule (36 CFR § 219.17(b)(3)). Land management planning guides the Forest Service in fulfilling its responsibilities for the stewardship of the Apache-Sitgreaves NFs to best meet the needs of the American people.

This plan provides broad guidance and information for project and activity decisionmaking on the Apache-Sitgreaves NFs for approximately the next 15 years. The plan is strategic in nature. It does not include project and activity decisions. Those decisions will be made later, after specific proposals are made and analyzed and there is additional opportunity for public involvement. Under the National Forest Management Act (NFMA) of 1976 (Public Law 94-588), projects and activities must be consistent with the plan (see “Plan Consistency” section below).

The plan provides a framework that contributes to sustaining native ecological systems by managing toward desired conditions that support native plant and animal diversity. The plan integrates forest restoration, watershed protection, vegetation resilience to ecological disturbances, wildlife conservation, and contributions to social and economic values, goods, and services. The plan honors the continuing validity of private, statutory, or pre-existing rights.

[1] According to the Apache-Sitgreaves NFs’ Geographic Information System (GIS) data, total forest acreage in 2012 was 2,110,196 acres (2,015,352 acres NFS land and 94,844 acres of non-NFS land).

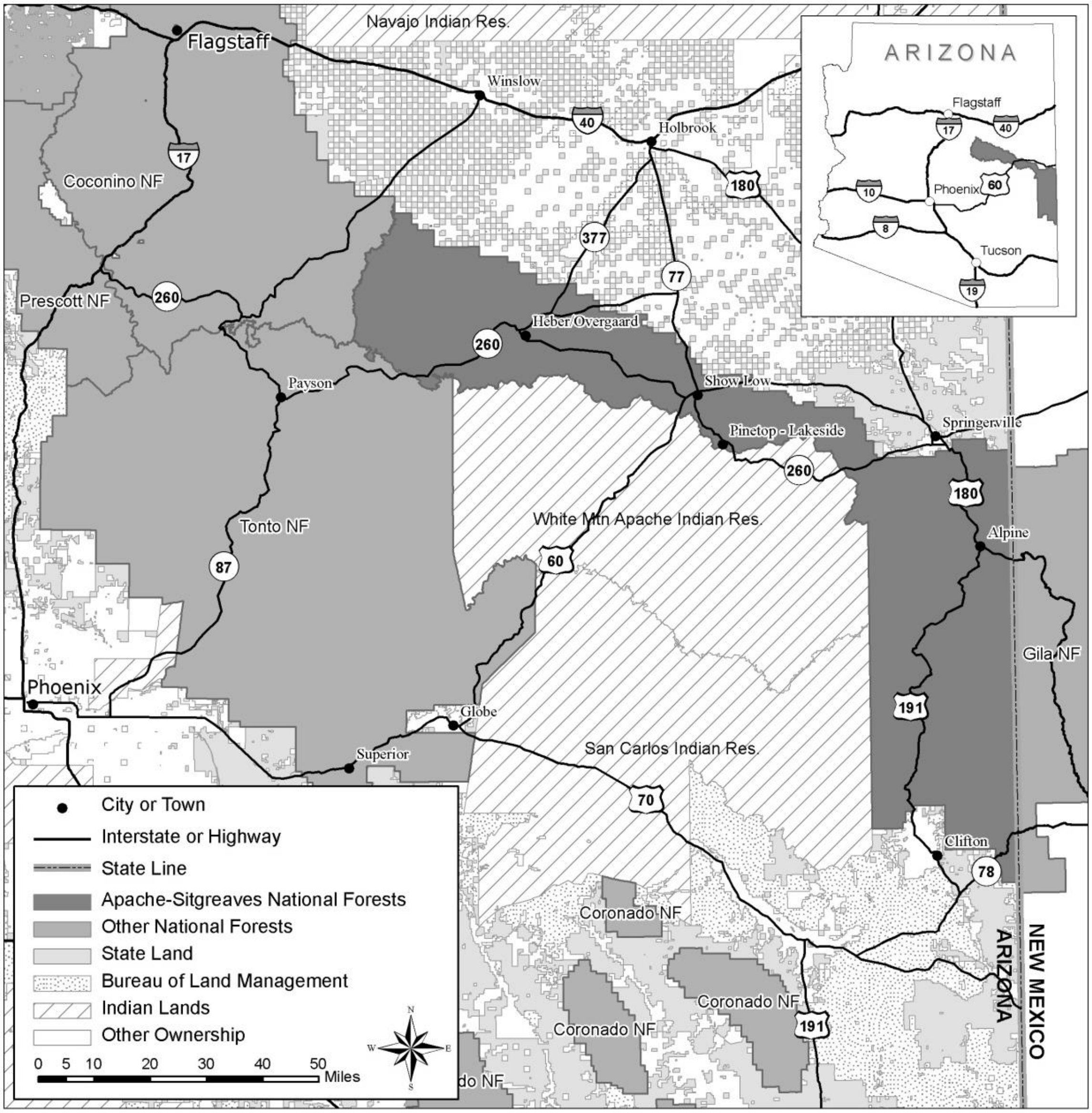

Figure 1. The Apache-Sitgreaves NFs and adjacent landowners

Summary of the Analysis of the Management Situation

The management situation is described in the Comprehensive Evaluation Report or CER (Forest Service, 2008a) and CER Supplement (Forest Service, 2010). Together these documents meet the content requirements of the Analysis of the Management Situation or AMS, as required by the procedures of the 1982 Planning Rule, by describing the social, economic, and ecological conditions and trends in and around the Apache-Sitgreaves NFs. The CER integrates key findings from the Ecological Sustainability Report (Forest Service, 2008b), the Economic and Social Sustainability Assessment (Forest Service, 2009a), Resource Evaluations (Forest Service, 2008c), and input from the public and Forest Service employees. The CER notes where the former land management plan (the 1987 plan) does not provide adequate management guidance for the

present and future, and it identifies where the conditions and trends indicate a need for change from the 1987 plan.

The CER/AMS identifies three primary areas, or revision topics, where there are priority needs for change in program direction.

1. Maintenance and Improvement of Ecosystem Health
2. Managed Recreation
3. Community–Forest Interaction

Maintenance and Improvement of Ecosystem Health

Conditions have changed since the forest plan was issued in 1987 including the recognition that vegetation conditions (structure, composition, and function) are divergent from reference conditions; forest conditions indicate a substantial departure from the natural fire regime; and there are plant and animal species which need further consideration in the planning process. There are also emerging issues not addressed by the 1987 plan (e.g., nonnative invasive plants and animals, climate change).

The following are needs for change to the 1987 plan:

- Better describe desired conditions for the vegetative communities of the forests. The vegetative communities include ponderosa pine, wet mixed conifer, dry mixed conifer, spruce-fir, and aspen forests; piñon-juniper and Madrean pine-oak woodlands; Great Basin, semi-desert and montane/subalpine grasslands; interior chaparral, mixed broadleaf deciduous, montane willow, and cottonwood-willow riparian forests; and wetland/cienega riparian areas. There is a need to describe the desired composition, structure, and cover of these vegetation communities that will result in resilient, functioning ecosystems.
- Identify the desired fire regimes that will help restore fire to a more natural role as one of the forests' primary disturbance agents.
- Provide direction to guide future vegetation management activities, including burning and mechanical treatments, to move toward or maintain desired conditions.
- Incorporate management direction to guide future projects to provide habitat to maintain viable populations of existing native and desired nonnative vertebrate species in the planning area.
- Include appropriate standards and guidelines to provide direction to maintain species diversity and viability across the planning area.
- Reevaluate and update the management indicator species (MIS). MIS are species whose population changes are believed to indicate the effects of management activities. MIS are selected to allow evaluation of the differences between alternatives in the environmental impact statement.
- Add plan components to provide future project direction to control, treat, and eradicate nonnative plant and animal invasive species.
- Address the emerging issue of climate change by incorporating adaptive management strategies and describing ecological conditions that are resilient to change.

Managed Recreation

There are several concerns related to unmanaged recreation that are not adequately addressed in the 1987 plan. These include increasing recreational use of the forests and changing demographics of forest users. There are also special areas that were not mentioned in the 1987 plan (e.g., scenic byways), as well as rivers that are eligible for the National Wild and Scenic Rivers System. There may be National Forest System lands that could be recommended to Congress for designation into the National Wilderness Preservation System.

The following are needs for change to the 1987 plan:

- Update the spectrum of recreation opportunities to reflect current and projected recreation needs, natural resource impacts, and public input. This includes identification of areas that are developed for high use and areas that resemble more natural landscapes.
- Identify the suitability of areas on the forests for motorized vehicle use and other recreational activities.
- Incorporate direction for special areas that were not included in the 1987 plan, including recommended research natural areas, the Heber Wild Horse Territory, scenic byways, and national recreation trails.
- Recommend additional special areas (i.e., research natural areas) where needed. The intent is to recommend these areas in the revised forest plan; subsequent analyses would determine whether they should become official designated areas.
- Recognize the management requirements for rivers that are eligible or suitable for the National Wild and Scenic Rivers System.
- Evaluate lands for wilderness potential and, if determined to be appropriate by the responsible official, recommend designation by Congress and provide interim management guidance.

Community–Forest Interaction

There are several social concerns that cause a need to change the 1987 plan. Communities are at risk from uncharacteristic wildfire. There are increasing demands for goods, services, and forest access from growing populations and urban developments that border the forests. Many communities are surrounded by the forests and can be affected by adjustment to the forests' land ownership. Commodity use and production have shown declines from the past. However, these forest uses contribute to sustaining the lifestyles and traditions of local communities. Energy resource demands also continue to grow.

The following are needs for change to the 1987 plan:

- Provide direction to address communities at risk from uncharacteristic wildfire. This includes describing the appropriate vegetation desired conditions and fire regime and treatment of the wildland-urban interface.
- Provide guidelines and suitability determinations for addressing urban interface demands (e.g., access, trailheads, special use permits).
- Update guidelines regarding land ownership adjustments that better reflects community expansion needs and preservation of open space.

- Continue to provide a sustainable supply of forest and rangeland resources that is consistent with achieving desired conditions and supports local communities. Determine the suitability of lands for timber production and the allowable sale quantity of timber.
- Identify major existing energy (utility) corridors and provide management direction for these areas. Update the criteria for establishing new energy corridors.

Other needs for change have been and will continue to be identified. New information and changing conditions will necessitate changes in management. As these become ripe for action, iterative and adaptive management may result in changes to the plan. For example, following the 538,000-acre Wallow Fire of 2011, a changed condition assessment (Forest Service, 2012b) was conducted and the information was used in the development of this plan, in particular the "Landscape Scale Disturbance Events" section in chapter 2.

Plan Consistency

As required by the National Forest Management Act (NFMA) and the National Forest System Land Management Planning Rule, all projects and activities authorized by the Forest Service must be consistent with the plan. As projects and activities are planned, an interdisciplinary team assesses the potential environmental, physical, biological, aesthetic, cultural, engineering, and economic impacts on the area.

Projects and activities include all actions under 16 USC 1604(i). A project or activity must be consistent with the plan by being consistent with applicable plan decisions (see the "Plan Decisions" section below).

Plans also contain other content (see the "Other Content" section below). Projects and activities are not required to be consistent with this other content.

Where a proposed project or activity would not be consistent with a plan decision, the responsible official has the following options:

- To modify the proposal so that the project or activity will be consistent;
- To reject the proposal; or
- To amend the plan at the same time as the approval of the project or activity so that the project or activity is consistent with the plan as amended. The amendment may be limited to apply only to the project or activity.

Plan Content

This plan includes plan decisions and other content. Any substantive changes to plan decisions will require a plan amendment. A change to other content may be made using an administrative change process. See the "Changes to the Plan" section below for more information.

Plan Decisions

Plan decisions include goals (hereafter identified as desired conditions), objectives, standards, guidelines, suitability, special areas, and monitoring. Plan decisions apply to projects or activities where site conditions provide an inherent capability to meet those plan decisions. Plan decisions

for the portion of the Apache NF located in New Mexico can be found in the Gila National Forest land management plan.

> Plan decisions for forestwide direction and management areas are displayed in shaded boxes to distinguish them from other sections of the plan.

Plan decisions for suitability and monitoring are found in their respective tables in chapters 4 and 5.

Desired Conditions

Desired conditions set forth the desired social, economic, and ecological attributes of the Apache-Sitgreaves NFs. They attempt to paint a picture of what we (the public and Forest Service) desire the forests look like or the goods and services we desire them to provide. Desired conditions are normally expressed in broad, general terms and are timeless in that there is no specific date by which they are to be completed. Desired conditions may only be achievable over a long timeframe (in some cases, several hundred years). In some cases, a desired condition matches the current condition, so the goal is to maintain the existing condition. Desired conditions are aspirations and are not commitments or final decisions approving projects.

To be consistent with the desired conditions of the plan, a project or activity, when assessed at the appropriate spatial scale described in the plan (e.g., landscape scale), must be designed to meet one or more of the following conditions:

- Maintain or make progress toward one or more of the desired conditions of a plan without adversely affecting progress toward, or maintenance of, other desired conditions; or
- Be neutral with regard to progress toward plan desired conditions; or
- Maintain or make progress toward one or more of the desired conditions over the long term, even if the project or activity would adversely affect progress toward or maintenance of one or more desired conditions in the short term; or
- Maintain or make progress toward one or more of the desired conditions over the long term, even if the project or activity would adversely affect progress toward other desired conditions in a negligible way over the long term.

The project documentation should explain how the project is consistent with desired conditions and describe any short term or negligible long term adverse effects the project may have concerning the maintenance or attainment of any desired condition.

Objectives

Objectives are concise, time-specific statements of measurable planned results that make progress toward or maintain desired conditions. An objective forms the basis for further planning to define the precise steps to be taken and the resources to be used in achieving desired conditions. The objectives represent just some of the expected outcomes or actions required to accomplish movement toward desired conditions. Not every action the Apache-Sitgreaves NFs may initiate is identified in the plan, just the primary ones.

Objectives are strongly influenced by recent trends, past experiences and anticipated staffing levels, and short term budgets. Variation in achieving objectives may occur during the next 15 years because of changes in environmental conditions, available budgets, and other factors. Additionally, objectives are stated as annual ranges (e.g., treat 5,000 to 35,000 acres annually). However, more than 35,000 or less than 5,000 acres may be treated in one or more years, but the annual average over the life of the plan (15 years) would fall within the objective range.

A project or activity is consistent with the objectives of the plan if it contributes to or does not prevent the attainment of any applicable objectives. The project documentation should identify any applicable objective(s) to which the project contributes and document that the project does not prevent the attainment of any objectives. If there are no applicable objectives, the project must be consistent with the objectives of the plan, and the project document should state that fact.

Standards

Standards are constraints upon project and activity decisionmaking. A project or activity must be consistent with all standards applicable to the type of project or activity and its location in the plan area. A project or activity is consistent with a standard in only one way:

1. The project or activity is designed in exact accord with the standard.

Variance from a standard is not allowed except by plan amendment. The project documentation should confirm that the project is consistent with applicable standards.

Guidelines

A project or activity must be consistent with all guidelines applicable to the type of project or activity and its location in the plan area. A project or activity is consistent with a guideline in either of two ways:

1. The project or activity is designed exactly in accord with the guideline; or
2. A project or activity design varies from the exact words of the guideline, but it is as effective in meeting the purpose of the guideline to contribute to the maintenance or attainment of the relevant desired conditions and objectives.

The project record should contain documentation describing how the project is consistent with the applicable plan guidelines. Guidelines must be followed, but they may be modified for a specific project if the intent of the guideline is followed and the deviation is addressed in the project record with supporting rationale. However, when deviation from a guideline does not meet the original intent, a plan amendment is required.

Special Areas

Special areas are lands that have designations by Congress or another delegated authority. Special areas are designated because of their unique or special characteristics. This plan provides direction for the following special areas: scenic byways, national recreation trails, eligible and suitable wild and scenic rivers, a botanical area, designated and recommended research natural areas, wild horse territory, designated and recommended wilderness, and a primitive area.

Where the plan provides plan decisions specific to a special area, a project or activity must be consistent with those area-specific decisions. The project documentation should describe how the project or activity is consistent with the area-specific decisions of the plan.

Suitability

Suitability describes the appropriateness of applying certain resource management practices (uses) to a particular area of land. A unit of land may be suitable for a variety of individual or combined uses.

A project with the purpose of timber production may only occur in an area identified as suitable for timber production (16 USC 1604(k)). The documentation for the project should confirm the project area meets the suitability requirements.

Except for projects with a purpose of timber production, a project or activity can be consistent with plan suitability determinations in either of two ways:

1. The project or activity is a use identified in the plan as suitable for the location where the project or activity is to occur; or
2. The project or activity is not a use identified in the plan as suitable for the location (i.e., the plan is silent on the use or the plan identifies the use as not suitable), but the responsible official determines that the use is appropriate for that location's desired conditions and objectives.

The project documentation should describe that the project or activity is either: (1) a use for which the area is specifically identified in the plan as suitable or (2) not a use for which the area is specifically identified in the plan as suitable, but it is nonetheless appropriate for that location.

Monitoring

Monitoring is used to determine the degree to which on the ground management is maintaining or making progress toward desired conditions. The monitoring strategy includes questions and performance measures designed to inform implementation and effectiveness of plan decisions. It helps ensure that the plan remains adaptive, in that new knowledge and information can be analyzed and the plan modified as needed.

Other Content

Besides the plan decisions mentioned above, the plan also contains other content that are not plan decisions. Other content includes chapter 1, certain sections in chapters 2 and 3 that are not displayed in shaded boxes, sections of chapters 4 and 5 that are not displayed in tables (i.e., background, management approaches, related plan content), and all appendices.

Background

The "Background" section provides a narrative regarding resource conditions. The primary information sources for this section are the Comprehensive Evaluation Report (Forest Service, 2008a), Ecological Sustainability Report (Forest Service, 2008b), Economic and Social Sustainability Assessment (Forest Service, 2009a), Resource Evaluations (Forest Service, 2008c), and the Wallow Fire Changed Condition Assessment (Forest Service, 2012b).

Management Approaches

The “Management Approaches” section identifies probable management actions for achieving desired conditions and objectives. Management approaches describe the priorities and expectations for future program implementation. Partnerships and collaborative arrangements for accomplishing desired conditions are also included as part of management approaches. Management approaches are strongly influenced by recent trends, past experiences, and anticipated staffing levels and short term budgets. Decisions about what projects or activities are actually proposed and approved, as well as details of project design, are determined by public involvement, science, and professional experience at the project or activity level.

Related Plan Content

The “Related Plan Content” section lists other portions of the plan that contain associated information.

Other

It should be noted that acreages and mileages listed in the plan are approximate. They were calculated using the most current data available in the Apache-Sitgreaves NFs’ Geographic Information System (GIS). As the GIS database is updated, these measurements may change.

Changes to the Plan

A change to the plan requires either an administrative change or amendment. The following summarizes circumstances that warrant administrative changes or amendments to the plan.

Administrative Changes

An administrative change is any future change to the plan (after the revised plan goes into effect) that does not require a plan amendment or plan revision. They are minor changes to the plan that do not substantively affect the management direction or create additional environmental consequences. These minor changes include the following:

- Corrections of clerical errors to any part of the plan;
- Conformance of the plan to new statutory or regulatory requirements;
- Changes to elements of the plan that are not plan decisions as described in the “Other Content” section above; and
- Changes to the plan monitoring strategy, after notice is made to the public of the intended change and consideration has been given to public comment and feedback.

The procedures for administrative changes are outlined in 36 CFR § 219.13(c) of the 2012 Planning Rule.

Site-Specific Plan Amendments

Site-specific plan amendments allow specific projects or other activities to deviate from certain plan decisions. These amendments apply only to the specific project or activity; they do not permanently modify the plan. If changes are made to management area map GIS layers (data), they are made only for the area affected. Such amendments are usually proposed with appropriate

environmental analysis for the site-specific project proposal. The procedures for a site-specific plan amendment are outlined in the applicable planning regulation.

Programmatic Plan Amendments

Programmatic plan amendments change the text and language of the plan decisions identified in the earlier “Plan Decisions” section and any other changes that cannot be addressed through the administrative change process or site-specific plan amendments. These are permanent changes that apply to all future projects. The procedures for addressing a programmatic plan amendment are outlined in the applicable planning regulation.

Plan Organization

Chapter 1. Background – briefly describes the Apache-Sitgreaves NFs, the analysis of the management situation, the purpose of this plan, plan content, and plan organization. For a quick preview of the plan structure, glance at the table of contents. This chapter does not contain any plan decisions.

Chapter 2. Forestwide Direction – contains plan decisions and other content that are applicable forestwide.

Chapter 3. Management Area Direction – contains plan decisions and other content that is applicable to particular management areas. The Apache-Sitgreaves NFs are divided into 12 management areas.

Chapter 4. Suitability – describes the appropriateness of certain resource management practices (uses) across the forests.

Chapter 5. Monitoring Strategy – contains the monitoring plan decisions and provides a framework for subsequent monitoring and evaluation.

Glossary – provides definitions of select words from this plan. These words are noted by hypertext at least once in the main document.

Appendix A. Climate Change Trends and Apache-Sitgreaves NFs Land Management Planning – provides information and discussion about climate change in the Southwestern Region of the Forest Service and considerations for land management planning.

Appendix B. Vegetation Conditions and Management Practices – describes the current (2011) and desired future conditions for the 14 major potential natural vegetation types (PNVTs) on the forests, as well as management practices that may be used to maintain or make progress toward desired conditions.

Appendix C. Communications Sites – identifies the designated communications sites located on the Apache-Sitgreaves NFs.

Appendix D. Relevant Laws, Regulations, Policies, and Other Sources of Information – provides a partial listing of relevant statutes, regulations, and policies applicable to the Forest Service.

Appendix E. Proposed and Possible Management Actions – lists proposed and possible management actions that may take place on the Apache-Sitgreaves NFs at the project or activity level during the planning period.

Appendix F. Maps – contains maps of management areas.

Hypertext is used throughout the plan—it allows the user of the electronic version of this plan to click on a word (indicated by underlined text) and be redirected to another area of the plan or an external reference. Note: the first occurrence of a word that is found in the glossary is hyperlinked, for example Glossary.

Roles and Contributions of the Apache-Sitgreaves NFs

The distinctive characteristics of the Apache-Sitgreaves NFs frame the roles it plays and contributions it provides to the local area, the State, the Southwestern Region, and the Nation. The forests are located along and below the Mogollon Rim, an abrupt escarpment which is the southern boundary of the Colorado Plateau and splits Arizona into low elevation deserts and high elevation mountains and plateaus. The forests encompass mountains, hills, cinder cones, plains, plateaus, deep canyons, and escarpments. Elevations range from about 3,500 feet in the Clifton area to 11,400 feet on Mount Baldy[2] near Springerville.

Figure 2. Fall colors, Apache-Sitgreaves NFs

The diverse vegetation ranges from semi-desert grasslands to high elevation spruce-fir forests. The Apache-Sitgreaves NFs contain a portion of the largest ponderosa pine forest in the world and the most extensive montane and subalpine grasslands in Arizona. Many of the unique riparian vegetation types of Arizona are found within the Apache-Sitgreaves NFs.

The Apache-Sitgreaves NFs are a distinctive and important component of the arid Southwest, containing over 30 lakes and reservoirs and more than 1,000 miles of rivers and perennial streams, more than any other Arizona national forest. The forests contain the headwaters of several major Arizona river systems, including the Little Colorado, Black, Blue, and San Francisco.

[2] The summit of Mount Baldy is within the Fort Apache Indian Reservation just outside the Apache-Sitgreaves NFs' boundary.

Diverse ecosystems provide habitat for a wide array of wildlife, fish, and plants; some of which can only be found in this area. Unique species include Apache trout, Springerville pocket mouse, White Mountains ground squirrel, Three Forks springsnail, and Mogollon paintbrush. The Apache-Sitgreaves NFs are one of two national forests in the Nation to provide a home for the recovery of the Mexican gray wolf (Mexican wolf).

Most visitors to the Apache-Sitgreaves NFs come from Arizona's metropolitan areas, seeking a respite from the desert heat or the noise and/or confinement of urban living. Many are drawn to the water-based activities; while others enjoy the diverse scenery of vast rolling grasslands, rugged desert terrain, and lush alpine forests.

Forest visitors enjoy the recreation opportunities of the Apache-Sitgreaves NFs, including three scenic byways and several popular developed recreation areas. The forests also provide an abundance of dispersed recreation opportunities. Three wilderness areas and the Nation's only primitive area provide opportunities for solitude and backcountry experiences. Over a thousand miles of trails provide ample hiking, bicycling, horseback, and off-highway vehicle access to natural highlights of the forests' landscape. Big game hunting and fishing in some of the best lakes and streams of the Southwest are popular activities. The forests are also a destination for winter activities: snow play, snowmobiling, ice fishing, cross-country skiing, and sledding.

Many people, some of whom have long-time connections to the forests, have an interest in and use the Apache-Sitgreaves NFs. American Indian tribes and many local residents have traditional ties, such as forest product collection, hunting, and large group gatherings. Loggers and ranchers continue to be an important part of the forests' history, and their traditional uses remain an important part of the cultural landscape.

Additional values that make the Apache-Sitgreaves NFs unique in a national and regional context include the following:

- Visitors use the Apache-Sitgreaves NFs as a place to stay overnight more than any other forest in the National Forest System (Stynes and White, 2005).
- Aldo Leopold, known as the father of wildlife conservation, served as a timber cruiser on the Apache National Forest from 1909 to 1911.
- All but one of the Arizona big game species (bison) can be found on the forests. Species include pronghorn antelope, black bear, bighorn sheep, elk, javelina, turkey, mountain lion, mule deer, and white-tailed deer.
- Nine of the 21 Outstanding Arizona Waters are on the Apache-Sitgreaves NFs. These streams are considered outstanding State resources.
- Twenty-one of the Apache-Sitgreaves NFs' rivers (and creeks) are eligible and two are suitable for inclusion in the National Wild and Scenic Rivers System.
- At 50 miles long, the Blue River is one of the longest stretches in the State with native fish species.
- The highest lightning frequency in Arizona occurs along the Mogollon Rim and the White Mountains.

The Apache-Sitgreaves NFs Mission

The phrase, “Caring for the Land and Serving People,” succinctly captures the Forest Service mission. The mission is to sustain the health, diversity, and productivity of the Nation’s forests and grasslands to meet the needs of present and future generations. The overall goal of managing National Forest System lands is to sustain the multiple uses of its resources in perpetuity while maintaining the long term productivity of the land.

The Apache-Sitgreaves NFs staff strives to effectively and efficiently manage National Forest System lands and resources to meet the needs and desires of the public following applicable laws, regulations, and policies while enhancing the environment.

The Apache-Sitgreaves NFs Vision

The Apache-Sitgreaves NFs effectively manage for resiliency across the landscape. We ensure the perpetuation of a broad range of diverse habitats, exceptional recreation opportunities, functioning watersheds, robust rangelands, and a balanced flow of forest resources for future generations. We integrate community values and protection into all aspects of forest management.

Our employees are appreciated individually for their contributions and embrace safety as a core value. We embrace diversity and a collaborative approach with each other and the public. Our work is efficient, innovative, and adaptive.

Chapter 2. Forestwide Direction

Introduction

This chapter sets forth plan decisions and other content that apply forestwide. See chapter 1 for descriptions of plan decisions and other content. In the event of conflicts with other sections of this plan, the more restrictive plan decision generally applies. However, a project or activity level evaluation may be required to resolve the conflict. Plan decisions apply to projects or activities where site conditions provide an inherent capability to meet those plan decisions.

Plan decisions for forestwide direction are displayed in shaded boxes to distinguish them from other sections of the plan.

Plan decisions and other content for management areas (chapter 3) and suitability (chapter 4) should also be consulted.

Maintenance and Improvement of Ecosystem Health

Healthy ecosystems are diverse and self-sustaining, displaying a variety of conditions (e.g., composition, structure, function, processes) between and within them. Ecosystem diversity includes the distribution, complexity, and natural disturbance regimes of watershed and landscape scale features, affecting terrestrial, aquatic, and riparian ecosystems. Communities, populations, and individual plant and animal species are uniquely adapted to and dependent upon ecosystem diversity.

The following desired conditions describe the characteristics of the Apache-Sitgreaves NFs that provide ecosystem diversity. Ecosystem diversity is the primary means by which this plan contributes to the maintenance and improvement of ecosystem health. Species diversity needs are accounted for in all aspects of this plan. Social and economic needs are also integrated into ecosystem desired conditions.

The ecological desired conditions are described at multiple scales and may only be achievable over a long timeframe (several hundred years). Descriptions at various scales are developed to provide detail and guidance for the design of future projects and activities that help achieve the desired conditions over time. Descriptions under the landscape scale provide the "big picture" desired conditions for terrestrial resources across the larger land area. Descriptions at the mid-scale and fine scale provide further details necessary for guiding future site-specific projects and activities. A combination of fine scale units add up to the mid-scale and a combination of mid-scale units add up to the landscape scale. Conversely, desired conditions for aquatic resources are described using watershed scales to help provide their relative importance or niche. Conditions for larger land areas are described under the 4th level (subbasin) to 5th level (watershed) Hydrologic Unit Code (HUC) watershed scale. More detailed descriptions for site-specific conditions are described at the 6th level (subwatershed) HUC watershed scale. Not all resources require a description at each scale.

Overall Ecosystem Health

Background for Overall Ecosystem Health

Prior to the late 1800s, the Apache-Sitgreaves NFs ecosystems were considered to be resilient. The landscape was filled with a wide variety of vegetation that provided habitat for a diverse

array of plants and animals. Fire, disease, and weather variability were natural components of these functioning ecosystems.

Beginning in the late 1800s, Euro-American settlers began making substantial changes to the ecological and species diversity of the landscape. In some cases, the underlying ecological processes and disturbances that sustained diversity have been altered from historic patterns (Forest Service, 2008b) and may not support the same native species distribution and abundance. Under current conditions, natural ecological processes (e.g., insects, disease, fire, climate change) are producing uncharacteristic outcomes (e.g., 2002 Rodeo-Chediski Fire, 2011 Wallow Fire, spruce-fir and piñon die off) in many ecosystems.

Public needs as well as public expectations regarding management of the national forests and grasslands have changed. Congress directed the Forest Service to manage National Forest System (NFS) lands for multiple uses and benefits and for the sustained yield of renewable resources. Multiple use means managing resources, under the best combination, to benefit the American people, while ensuring the sustained productivity of the land and protecting the quality of the environment into the future. There is general recognition of the principle that every use cannot occur on every acre of NFS land.

The Forest Service has identified uncharacteristic fire and the buildup of fuels, unmanaged recreation, invasive species, and the loss of open space as threats to the health and sustainability of the Nation's forests. In addition, climate change[1] has been added to the list of forces shaping the national forests and grasslands.

This plan provides a framework to contribute to ecological sustainability by identifying desired conditions that support diverse native plant and animal communities while protecting natural features and cultural resources. The needs for fish, wildlife, and rare plants are addressed throughout the plan, rather than in one specific section.

The intent of this plan is to guide management efforts in the restoration and/or maintenance of ecosystems by maintaining or moving towards desired conditions. Sustainable supplies of resources such as timber, recreation, and forage are byproducts of healthy, functioning ecosystems.

Desired Conditions for Overall Ecosystem Health

Landscape Scale Desired Conditions (10,000 acres or greater)

- Ecological components (e.g., soil, vegetation, water) are resilient to disturbances including human activities and natural ecological disturbances (e.g., fire, drought, wind, insects, disease, pathogens).

[1] The state of knowledge needed to deal with climate change at the forest scale is evolving and the potential outcomes, as a result of climate change, are uncertain. Most global climate models are not yet precise enough to apply to land management at the ecoregional or forest scale. This limits regional and forest-specific analysis of potential effects of climate change (see appendix A). However, based on current climate model projections and research, climate change factors that appear most likely to affect southwestern national forests and affect desired conditions are ecological, weather-related disturbances, and socioeconomic demands and include increases in (1) frequency of intense storms; (2) wildfire risks; (3) outbreaks of insects, diseases, and nonnative invasive species; (4) demand for decreasing water supplies; and (5) national forest socioeconomic uses and demands.

- Natural ecological disturbances return to their characteristic roles within the ecosystem. Wildfire, in particular, is restored to a more natural function.
- Natural ecological cycles (i.e., hydrologic, energy, nutrient) facilitate shifting of plant communities, structure, and ages across the landscape. Ecotone shifts are influenced at both the landscape and watershed scale by ecological processes. The mosaic of plant communities and the variety within the communities are resilient to disturbances.
- Ecological conditions for habitat quality, distribution, and abundance contribute to self-sustaining populations of native and desirable nonnative plants and animals that are healthy, well distributed, connected, and genetically diverse. Conditions provide for the life history, distribution, and natural population fluctuations of the species within the capability of the landscape.
- Large blocks of habitat are interconnected, allowing for behavioral and predator-prey interactions, and the persistence of metapopulations and highly interactive wildlife species across the landscape. Ecological connectivity extends through all plant communities.
- Habitat configuration and availability allows wildlife populations to adjust their movements (e.g., seasonal migration, foraging) in response to climate change and promote genetic flow between wildlife populations.
- Habitat quality, distribution, and abundance exist to support the recovery of federally listed species and the continued existence of all native and desirable nonnative species.
- Healthy ecosystems provide a wide range of ecosystem services.
- Watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition.

Objectives for Overall Ecosystem Health

- During the planning period, improve the condition class on at least 10 priority 6th level HUC watersheds by removing or mitigating degrading factors[2].

Management Approaches for Overall Ecosystem Health

In order to achieve overall ecosystem health and provide for species diversity, management focus is on achieving satisfactory watershed conditions and restoring ecological functions, especially natural fire regimes.

There is a concerted effort to restore priority 6th level HUC watersheds by reducing degrading factors. Priority 6th level watersheds are identified on an ongoing basis using the Watershed Condition Framework process. The 6-step “Watershed Condition Framework”[3] for improving

[2] Degrading factors include, but are not limited to, actions that cause or maintain high departure from historic vegetation conditions, unsatisfactory or impaired soil condition, nonfunctioning riparian areas, impaired species habitat, occurrence of invasive species, and unstable road and trail conditions.

[3] Information from the Watershed Condition Framework, including condition class and prioritization information, is available at http://apps.fs.usda.gov/WCFmapviewer/.

watershed condition class includes (1) rating watersheds for current condition, (2) prioritizing watersheds for treatment, (3) developing watershed action plans for the entire watershed (including non-NFS lands) that identify specific project level activities needed to change condition classes, (4) implementing integrated suites of projects within priority watersheds, (5) tracking restoration accomplishments, and (6) monitoring the effectiveness of change in condition.

Highest priority treatments are those that remove risk factors that may threaten the integrity of the watershed, specifically those that cause low geomorphic, hydrologic, and biotic integrity relative to the watershed's natural potential condition and that lead to unstable drainage networks or to conditions which may not support beneficial uses of water. Geomorphic integrity can be defined in terms of attributes such as slope stability, soil erosion, channel morphology, and other upslope, riparian, and aquatic habitat characteristics. Hydrologic integrity relates primarily to flow, sediment, and water quality attributes. Biological integrity is defined by the characteristics that influence the diversity and abundance of aquatic species, vegetation, and soil productivity. Specific objectives to reduce degrading factors can be found below in the "Soil," "Water Resources," "Aquatic Habitat," and "All PNVTs" (vegetation) sections. Treatments include those that restore and then maintain natural fire regimes, improve riparian condition, restore meadows or openings, repair gullies, and reduce erosion.

Wildland fire has played an important ecological role in shaping the vegetation on the Apache-Sitgreaves NFs. Forest managers utilize prescribed fire (planned ignitions) and wildfire (unplanned ignitions) to help reintroduce fire into the ecosystems, restore natural fire regimes, and remove excessive fuels. Fire may be used alone or in combination with other treatments. Direction for managing wildland fire is found in the "Wildland Fire Management" section.

Related Plan Content for Overall Ecosystem Health

See all sections listed under Maintenance and Improvement of Ecosystem Health in chapter 2.

Air

Background for Air

The Clean Air Act of 1972 (Public Law 92-500) and its subsequent amendments assign Federal land managers the responsibility to protect air quality related values in Class I airsheds and to protect human health and basic resource values in all areas.

Mount Baldy Wilderness (7,000 acres) is the only Class I airshed on the forests. This airshed is located directly above the wilderness. In Mount Baldy Wilderness, little to no deterioration of air quality is allowed. All other areas of the forests are Class II airsheds where only moderate deterioration of air quality is allowed.

Human health standards are defined in the National Ambient Air Quality Standards (NAAQS) set by the Environmental Protection Agency (EPA) for seven pollutants considered harmful to public health: carbon monoxide, lead, nitrogen dioxide, particulate matter 10 microns in size or smaller (PM_{10}), particulate matter 2.5 microns in size or smaller ($PM_{2.5}$), ozone, and sulfur dioxide. Population centers with the potential to be impacted from management activities on the Apache-Sitgreaves NFs are the Show Low/Pinetop-Lakeside, Eagar/Springerville, Winslow, Holbrook, Heber/Overgaard, and Payson areas. The Show Low/Pinetop-Lakeside, Eagar/Springerville,

Heber/Overgaard, and Payson areas are monitored continuously for fine particulates as they receive air drainage from the forests and nearby Fort Apache Indian Reservation. As determined by the State of Arizona, a portion of the forests falls within a sulfur dioxide (SO_2) maintenance plan area near Morenci. Disturbances as described within the forest plan (e.g., vehicles traveling on unpaved roads, smoke from fires) may have an insignificant impact on air quality within this nonattainment area.

Temporary decreases in air quality from management activities on the Apache-Sitgreaves NFs are primarily from prescribed fire. Wildfires also produce emissions and are subject to conformance with State regulations (see appendix D). The NAAQS pollutant of concern from wildland fire is fine particulate matter, both PM_{10} and $PM_{2.5}$. Studies indicate that 90 percent of smoke particles emitted from wildland fires are PM_{10}, and about 90 percent of PM_{10} is $PM_{2.5}$. Because of its small size, $PM_{2.5}$ has an especially long residence time in the atmosphere and penetrates deeply into the lungs.

The same fine particulate matter that poses health risks is also largely responsible for visibility impairment. The State of Arizona has developed a State implementation plan with long term strategies to make "reasonable progress: in improving visibility in Class I areas inside the state and in neighboring jurisdictions" (Environmental Protection Agency, 1999), and focuses on anthropogenic (human) sources of emissions.

Road dust has not been demonstrated to be a measurable contributor on a regional level to visibility in the 16 Class I areas located on the Colorado Plateau (Arizona Department of Environmental Quality, 2003). Although road dust has been a localized issue associated with implementation of some projects in the past, it has been addressed with site-specific mitigation measures.

Desired Conditions for Air

Landscape Scale Desired Conditions (10,000 acres or greater)

- Air quality related values, including high quality visual conditions, are maintained within the Class I airshed over Mount Baldy Wilderness.
- Class II airsheds meet State of Arizona air quality standards including those for visibility and public health.

Guidelines for Air

- During extended periods of burning, smoke should be monitored, in cooperation with the Arizona Department of Environmental Quality, for levels that may have impacts to human health from fine particulates.

Management Approaches for Air

The Apache-Sitgreaves NFs participate with the State of Arizona in the air quality regulatory process. Specialists review air permit applications for new and modified industrial facilities to ensure that their air emissions do not adversely impact the air quality related values (e.g., visibility) of federally protected Class I wilderness areas. Forest managers consider impacts to

Class I and II areas and follow State of Arizona permit and regulatory requirements for smoke production to help determine the management response for wildfires. Site-specific mitigation for fugitive dust is incorporated into ground-disturbing projects through implementation of best management practices (BMPs) and retention and replacement of ground cover.

Related Plan Content for Air

See the following sections: All PNVTs, Wildland Fire Management, and Wilderness.

Soil

Background for Soil

The soil surface is the crucial area where plant and animal organic matter accumulates, begins to decompose, and eventually becomes incorporated into soil. It is also the zone of maximum biological activity and nutrient release. The presence and distribution of topsoil is critical to vegetation productivity. The physical condition of the soil surface plays a key role in soil stability, nutrient cycling, and water infiltration; the soil condition rating is based on these factors.

Apache-Sitgreaves NFs have areas with unsatisfactory soil condition. Before the 2011 Wallow Fire, satisfactory soil condition was estimated to be about 70 percent of the Apache-Sitgreaves NFs acres forestwide, compared to reference condition of at least 95 percent. Soil condition within the Wallow Fire area was estimated to be 78 percent satisfactory pre-fire and was reduced to about 50 percent satisfactory post fire. Soil condition recovery is variable and highly dependent on pre-fire soil condition, soil burn severity, and future land uses. In addition, soils associated with naturally unstable geology (e.g., Datil formation, slow geologic landslides) contribute to sediment loads in downstream rivers.

Desired Conditions for Soil

Landscape Scale Desired Conditions (10,000 acres or greater)

- Ecological and hydrologic functions are not impaired by soil compaction.

Mid-Scale Desired Conditions (100 to 1,000 acres)

- Soil condition rating is satisfactory[4].
- Soils are stable within their natural capability[4]. Vegetation and litter limit accelerated erosion (e.g., rills, gullies, root exposure, topsoil loss) and contribute to soil deposition and development.
- Soils provide for diverse native plant species[5]. Vegetative ground cover (herbaceous vegetation and litter) is distributed evenly across the soil surface to promote nutrient cycling, water infiltration, and maintain natural fire regimes.

[4] Satisfactory soil condition exists when indicators signify that soil function is being sustained and soil is functioning properly and normally. The ability of soil to maintain resource values and sustain outputs is high.

[5] Species composition and cover amounts and the amount of vegetation and litter needed for soil protection are described by ecological unit in the "Terrestrial Ecosystem Survey for the Apache-Sitgreaves National Forests" (Laing et al., 1987, as amended).

- Biological soil crusts (e.g., mosses, lichens, algae, liverworts) are present and reestablished if potential exists.

Fine Scale Desired Conditions (less than 10 acres)

- Soil loss rates do not exceed tolerance soil loss rates[6].
- Logs and other woody material are distributed across the surface to maintain soil productivity[7].
- Vegetation and litter are sufficient to maintain and improve water infiltration, nutrient cycling, and soil stability.

Objectives for Soil

- Annually, enhance or restore an average of 350 acres within priority 6th level HUC watersheds, including treating the causes of State and federally designated impaired or threatened waters to improve watershed condition and water quality.

Guidelines for Soil

- Projects with ground-disturbing activities should be designed to minimize long and short term impacts to soil resources. Where disturbance cannot be avoided, project specific soil and water conservation practices should be developed.
- Severely disturbed sites should be revegetated with native plant species when loss of long term soil productivity is predicted.
- Locally collected seed should be used where available and cost effective. Seeds should be tested to ensure they are free from noxious weeds and invasive nonnative plants at a State certified seed testing laboratory before acceptance and mixing.
- Coarse woody debris retention and/or creation should be used as needed to help retain long term soil productivity.

Management Approaches for Soil

The forests emphasize restoration treatments in priority 6th level HUC watersheds that have a high risk to ecologic sustainability. There is also an effort to improve water quality impaired streams and water bodies. Restoration treatments may include seeding, mulching, stabilization of gullies, or obliteration of unauthorized routes.

The Terrestrial Ecosystem Survey (TES) for the Apache-Sitgreaves NFs was developed using local, regional, and southwestern U.S. research data collected prior to its publication in 1987. The

[6] Tolerance soil loss rates are the maximum rates that soil can erode and not reduce long term soil productivity. These were established for each terrestrial ecosystem mapping unit component and are described in the "Terrestrial Ecosystem Survey for the Apache-Sitgreaves National Forests" (Laing et al., 1987, as amended).

[7] The amount of woody material varies by PNVT; see vegetation desired conditions.

forests use ground cover and vegetation canopy cover provided for each mapping unit to establish resource value ratings for soil and plant health for many management activities, particularly in the analysis and monitoring of restoration treatments and for grazing allotment management. The TES will be updated as new information is available to reflect current conditions and concepts. Ecological site descriptions will be developed using the TES as a baseline for further refinement of resource value ratings.

Related Plan Content for Soil

See the following sections: Overall Ecosystem Health, All PNVTs, Water Resources, Dispersed Recreation, Motorized Opportunities, and Nonmotorized Opportunities.

Water Resources

Background for Water Resources

Lands within the forests form the headwaters for the Little Colorado, Black, Blue, and San Francisco Rivers which produce water for many uses throughout the State of Arizona. Streams and riparian areas occur at a higher density than any other area in the State. Watersheds and aquatic ecosystems have changed from reference conditions, but the location of stream channels has generally not changed. The demand for water resources is increasing.

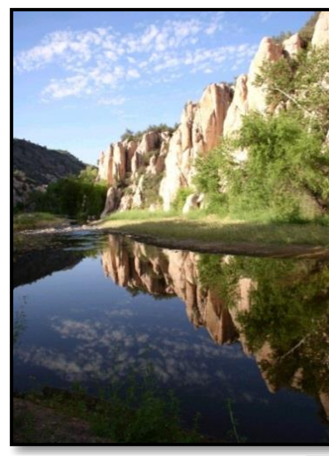

Figure 3. Blue River

Many riparian areas are not in proper functioning condition. Diversions, impoundments, unnaturally dense forests, grazing, and prolonged drought have altered streamflow and riparian condition. In addition, pumping from the Little Colorado groundwater aquifer associated with the forests is greater than the estimated recharge, resulting in reduced water availability and affecting some streamflows and groundwater dependent ecosystems.

Water quality is generally good, but there are some impaired streams and lakes. Suspended sediment is a potential nonpoint source water quality problem throughout the forests. There are nine Outstanding Arizona Waters on the forests.

Preserving streamflows is a challenge due to increased water demand and legal mandates for natural resources. Currently, the only avenue available to the Forest Service to preserve streamflows is to obtain water rights from the State of Arizona for instream flows. Arizona instream flow water rights are unique and provide the Forest Service with an opportunity to maintain and protect flow within streams so that fish and wildlife habitat and water-based recreation can be sustained. The Organic Administration Act[8] provided for the establishment of national forest lands for the purpose of securing favorable conditions of water flow, consistent with existing Federal or state water rights laws. Other Federal law[9] allows for diversions or impoundments of water as long as the environment is protected and damage to fish and wildlife habitat is minimized.

[8] Organic Administration Act, 1887 (16 USC 4751, 16 USC 481).

[9] Federal Land Policy and Management Act, 1976. Sec 505 (43 USC 1765).

Desired Conditions for Water Resources

4th Level (Subbasin) to 5th Level (Watershed) HUC Watershed Scale Desired Conditions

- Water quality, stream channel stability, and aquatic habitats retain their inherent resilience to natural and other disturbances.
- Water resources maintain the capability to respond and adjust to disturbances without long term adverse changes.
- Vegetation and soil conditions above the floodplain protect downstream water quality, quantity, and aquatic habitat.

6th Level (Subwatershed) HUC Watershed Scale Desired Conditions

- Instream flows provide for channel and floodplain maintenance, recharge of riparian aquifers, water quality, and minimal temperature fluctuations.
- Streamflows provide connectivity among fish populations and provide unobstructed routes critical for fulfilling needs of aquatic, riparian-dependent, and many upland species of plants and animals.
- Water quantity meets the needs for forest administration and authorized activities (e.g., livestock grazing, recreation, firefighting, domestic use, road maintenance).
- Stream channels and floodplains are dynamic and resilient to disturbances. The water and sediment balance between streams and their watersheds allow a natural frequency of low and high flows.
- Stream condition is sufficient to withstand floods without disrupting normal stream characteristics (e.g., water transport, sediment, woody material) or uncharacteristically altering stream dimensions (e.g., bankfull width, depth, slope, sinuosity).
- Floodplains are functioning and lessen the impacts of floods on human safety, health, and welfare.
- Water quality meets or exceeds Arizona State standards or Environmental Protection Agency water quality standards for designated uses.
- Water quality meets the needs of desirable aquatic species such as the California floater, northern and Chiricahua leopard frog, and invertebrates that support fish populations.

Standards for Water Resources

- Consistent with existing water rights, water diversions or obstructions shall at all times allow sufficient water to pass downstream to preserve minimum levels of water flow that maintain aquatic life and other purposes of national forest establishment.

Guidelines for Water Resources

- Projects with ground-disturbing activities should be designed to minimize long and short term impacts to water resources. Where disturbance cannot be avoided, project

specific soil and water conservation practices and best management practices (BMPs) should be developed.

- Streams, stream banks, shorelines, lakes, wetlands, seeps, springs and other bodies of water should be protected from detrimental changes[10] in water temperature and sediment to protect water quality, aquatic species and riparian habitat.
- Aquatic management zones should be in place between streams and disturbed areas and/or road locations to maintain water quality and suitable stream temperatures for aquatic species.
- As State of Arizona water rights permits (e.g., water impoundments, diversions) are issued, the base level of instream flow should be retained by the Apache-Sitgreaves NFs.
- Constraints (e.g., maximum limit to which water level can be drawn down or minimum distance from a connected river, stream, wetland, or groundwater-dependent ecosystem) should be established for new groundwater pumping sites permitted on NFS lands in order to protect the character and function of water resources.
- Short term impacts in watersheds containing Outstanding Arizona Waters may be allowed when long term benefits to water quality, riparian areas, and aquatic resources would occur.
- Treated wastewater may be used to provide wetland habitats.
- To protect water quality and aquatic species, heavy equipment and vehicles driven into a water body to accomplish work should be completely clean of petroleum residue. Water levels should be below the gear boxes of the equipment in use. Lubricants and fuels should be sealed such that inundation by water should not result in leaks.

Management Approaches for Water Resources

The width of aquatic management zones—generally 50 to 300 feet—is determined at the project level based on stream attributes (e.g., class and type, channel condition, aspect, side slope steepness, erosion hazard of adjacent lands). The aquatic management zone for waters with high resource value and quality would be at the greater width of this range. Management activities within aquatic management zones are either modified or excluded to mitigate impacts to aquatic resources. Aquatic management zone protection extends to riparian areas and groundwater-dependent ecosystem resources, such as springs, seeps, fens and bogs as well as karst/cave features.

Related Plan Content for Water Resources

See the following sections: Soil, Aquatic Habitat and Species, Riparian Areas, Dispersed Recreation, Motorized Opportunities, Nonmotorized Opportunities, Special Uses, and Water Uses.

[10] Detrimental changes are described in species-specific literature (e.g., recovery plans, listing and critical habitat designations, conservation strategies).

Aquatic Habitat and Species

Background for Aquatic Habitat and Species

The forests are home to 14 native and 24 nonnative fish species. Fish habitats range from high elevation cold water streams (trout) to the lower elevation warm water streams (minnow and sucker). Other aquatic species include Chiricahua leopard frog, narrow-headed gartersnake, and springsnails and other aquatic invertebrates.

Most streams have been altered from reference conditions, resulting in reduced quality of fish habitat. Inventoried streams have exhibited reduced habitat capabilities. Native fish populations and distributions are decreasing range-wide, and the resiliency of all fish species has been impacted. The alteration of habitats, isolation of populations, and introduction of nonnative species have contributed to the decline of native fish habitat and populations. Almost all of the forests' fish-bearing streams have been impacted by diversions. Some streams, during low flow years can be totally diverted, impacting habitat and aquatic species.

Invasive species are a serious and growing threat to native species. Nonnative invasive animals and plants, such as fish, crayfish, and Eurasian watermilfoil, prey on, out-compete, and degrade habitats that many native species depend on. In some cases, nonnative species are able to hybridize (crossbreed) with native species.

If climate change predictions become reality, a warmer and drier climate may further reduce the quality and quantity of wetlands that provide habitat for resident and migratory waterfowl and associated mammals, reptiles, and amphibians. Destruction of historic waterfowl congregation areas along the Colorado River and changes in migratory patterns have added to the importance of maintaining forest wetlands.

Desired Conditions for Aquatic Habitat and Species

4th Level (Subbasin) to 5th Level (Watershed) HUC Watershed Scale Desired Conditions

- Streams and aquatic habitats support native fish and/or other aquatic species providing the quantity and quality of aquatic habitat within reference conditions[11].
- Habitat conditions contribute to the recovery of federally listed species.
- Streamflows, habitat, and water quality support native aquatic and riparian-dependent species and habitat.

6th Level (Subwatershed) HUC Watershed Scale Desired Conditions

- Habitat and ecological conditions are capable of providing for self-sustaining populations of native, riparian-dependent plant and animal species.
- Native fish, reptile, amphibian, and invertebrate populations are free from or minimally impacted by nonnative plants and animals.
- Aquatic species habitat conditions provide the resiliency and redundancy necessary to maintain species diversity and metapopulations.

[11] Reference conditions are described in species-specific literature and research.

- Desirable nonnative fish species provide recreational fishing in waters where those opportunities are not in conflict with the recovery of native species.
- Wetlands are hydrologically functioning and have sufficient (composing 50 percent of the wetland) emergent vegetation and macroinvertebrate populations to support resident and migratory wetland dependent species.

Objectives for Aquatic Habitat and Species

- Annually, enhance or restore 5 to 15 miles of stream and riparian habitat to restore structure, composition, and function of physical habitat for native fisheries and riparian-dependent species.
- During the planning period, complete at least five projects (e.g., remove barriers, restore dewatered stream segments, or connect fragmented habitat) to provide for aquatic and riparian associated species and migratory species.

Standards for Aquatic Habitat and Species

- When drafting (withdrawing) water from streams or other water bodies, measures will be taken to prevent entrapment of fish and aquatic organisms and the spread of parasites or disease (e.g., Asian tapeworm, chytrid fungus, whirling disease).

Guidelines for Aquatic Habitat and Species

- Management and activities should not contribute to a trend toward the Federal listing of a species.
- Activities occurring within federally listed species habitat should apply habitat management direction and species protection measures from recovery plans.
- To prevent degradation of native species habitat and the incidental or accidental introduction of diseases or nonnative species, aquatic species should not be transferred through management activities from one 6^{th} level HUC watershed to another.
- Sufficient water should be left in streams to provide for aquatic species and riparian vegetation.
- Projects and activities should avoid damming or impounding free-flowing waters to provide streamflows needed for aquatic and riparian-dependent species.
- The needs of rare and unique species associated with wetlands, fens, bogs, and springs should be given priority consideration when developing these areas for waterfowl habitat and other uses.
- When new water diversions are created or existing water diversions are reanalyzed, measures should be taken to prevent entrapment of fish and aquatic organisms.

Management Approaches for Aquatic Habitat and Species

Proactive management of aquatic habitats and populations is critical to reversing downward population trends in several federally listed species. Physical barriers or habitat alterations like temperature changes, loss of streamflow, nonnative species predation, and nonnative hybridization can be threats to these species. Habitat improvement projects are prioritized with an emphasis on federally listed species and other species with population or habitat concerns. Managers work to ensure native species can be found in their historic habitat.

The Apache-Sitgreaves NFs assist the Arizona Game and Fish Department (AZGFD) with efforts to protect and reintroduce native aquatic species where appropriate and control or eradicate nonnative species. The forests support efforts to develop effective methods to eradicate crayfish and other undesirable nonnative species. The Apache-Sitgreaves National Forests coordinate with and support the AZGFD in the use of aquatic habitat and species improvement methods in order to move aquatic resources toward desired conditions when such methods are consistent with applicable plan components.

Enhancement or restoration treatments may include stabilization of stream banks and road crossings, facilitation of aquatic species passage and movement, restoration of perennial flows and native vegetation, or removal of unneeded impoundments. Ephemeral and seasonal wetlands are managed to lengthen wet periods. Wetlands are protected from activities that reduce habitat quality or size such as dewatering or loss of emergent vegetation.

Related Plan Content for Aquatic Habitat and Species

See the following sections: Overall Ecosystem Health, Water Resources, Riparian Areas, Invasive Species, Livestock Grazing, and Water Uses.

All PNVTs

Background for All PNVTs

The 14 major PNVTs[12] can be assembled into 5 groupings: riparian, forest, woodland, grassland, and chaparral. This section pertains to all 5 groupings and all 14 PNVTs. Each PNVT consists of one or more subtypes depending on local environmental characteristics. These subtypes (e.g., pine-Gambel oak is a subtype of the ponderosa pine PNVT) are not described in detail in this plan but may be evaluated at the project or activity level.

Riparian PNVTs include wetland/cienegas and three riparian forested PNVTs: mixed broadleaf deciduous, montane willow, and cottonwood-willow. There are four forested PNVTs: ponderosa pine, dry mixed conifer, wet mixed conifer, and spruce-fir. Madrean pine-oak and piñon-juniper make up the woodland PNVTs. The three grassland PNVTs are Great Basin, semi-desert, and montane/subalpine. Interior chaparral is the only chaparral PNVT.

All of these PNVTs vary, to some degree, in structure, composition, function, and natural ecological processes from what they were historically. Fire and climate change are among the most important natural ecological disturbances that shaped these vegetation communities.

The variety of habitat conditions provides for a wide diversity of plant species. Preliminary estimates include over 2,500 species and varieties. Vegetation conditions for Mexican spotted owl (MSO) and other federally listed species, although not described in detail below, are managed consistent with the habitat requirements specified in the appropriate species recovery plan.

---

[12] This plan refers to PNVT, meaning the potential natural vegetation type. Refer to appendix B for more information.

Ranges of values presented in desired conditions reflect varying multiple use needs and/or the natural variation in the composition and structure within a PNVT due to soils, elevation, and aspect. The desired conditions do not necessarily represent reference conditions, since it may not be possible, nor desirable, to return to that condition. Additional information on desired conditions for overstory and understory vegetation can be found in appendix B.

Desired conditions are described at multiple scales when possible. **Fine scale** is a 10-acre or less area at which the distribution of individual trees (single, grouped, or aggregates of groups) is described. **Mid-scale** is a unit of 100 to 1,000 acres and is composed of assemblages of fine scale units which have similar biophysical conditions. **Landscape scale** is an assemblage of mid-scale units, typically composed of variable elevations, slopes, aspects, soils, plant associations, and ecological processes. An area at this scale comprises multiple mid-scale units, most often 10 or more.

Desired Conditions for All PNVTs

Landscape Scale Desired Conditions (10,000 acres or greater)

- Each PNVT contains a mosaic of vegetative conditions, densities, and structures. This mosaic occurs at a variety of scales across landscapes and watersheds. The distribution of physical and biological conditions is appropriate to the natural disturbance regimes affecting the area.
- The vegetative conditions and functions are resilient to the frequency, extent, and severity of disturbances (e.g., fire, insects and disease, flood, climate change, management activities). The landscape is a functioning ecosystem that contains all its components and processes.
- Natural processes and human and natural disturbances (e.g., wildland fire, mechanical vegetation treatments) provide desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling. Natural fire regimes are restored. Uncharacteristic fire behavior is minimal or absent on the landscape.
- Wildland fire maintains and enhances resources and, as nearly as possible, is allowed to function in its natural ecological role.
- Native plant communities dominate the landscape.
- Species genetic diversity remains within native vegetation and animal populations, thus enabling species to adapt to changing environmental and climatic conditions.
- Vegetative connectivity provides for species dispersal, genetic exchange, and daily and seasonal movements across multiple spatial scales.
- Vegetation characteristics (e.g., density, litter) provide favorable conditions for water flow and quality.
- Organic soil cover and herbaceous vegetation protect soil, facilitate moisture infiltration, and contribute to plant and animal diversity and ecosystem function.
- Diverse vegetation structure, species composition, densities, and seral states provide quality habitat for native and desirable nonnative plant and animal species throughout their life cycle and at multiple spatial scales. Landscapes provide for the full range of

ecosystem diversity at multiple scales, including habitats for those species associated with late seral states and old growth.

- Old growth is dynamic in nature, well distributed, and spatially shifts across forest and woodland landscapes over time.
- Old or large trees, multistoried canopies, large coarse woody debris, and snags provide the structure, function, and associated vegetation composition as appropriate for each forested and woodland PNVT.
- Vegetation conditions allow for transition zones or ecotones between riparian areas, forests, woodlands, shrublands, and grasslands. Transition zones may shift in time and space due to changing site conditions from disturbances (e.g., fire, climate change).
- Insect and disease populations are at endemic levels with occasional outbreaks. A variety of seral states usually restricts the scale of localized insect and disease outbreaks.
- Disjunct populations of Chihuahuan pine, Arizona cypress, and Rocky Mountain maple are present with the ability to reproduce on capable sites.
- Herbivory is in balance with available forage (i.e., grazing and browsing by authorized livestock, wild horses, and wildlife do not exceed available forage production within established use levels).
- Vegetation conditions within each PNVT should be similar to site potential[13].
- Shrub components contain a diverse array of native vegetation that is well distributed across the landscape to provide nutritional needs for browsers.
- Vegetation provides products—such as wood fiber or forage—to help meet local and regional needs in a manner that is consistent with other desired conditions on a sustainable basis within the capacity of the land.
- Ecosystem services are available as forests, woodlands, grasslands, and riparian communities successfully adapt to a changing and variable climate.

Mid-Scale Desired Conditions (100 to 1,000 acres)

- Stand densities and species compositions are such that vegetation conditions are resilient under a variety of potential future climates.
- Vegetation conditions provide hiding and thermal cover in contiguous blocks for wildlife. Native plant species are present in all age classes and are healthy, reproducing, and persisting.
- Vegetative ground cover (herbaceous vegetation and litter) is optimized[14] to protect and enrich soils and promote water infiltration. There is a diverse mix of cool and warm season grasses and desirable forbs species.

[13] Similarity refers to a method of comparing the composition of the existing plant community to the potential natural plant community as described by the ecological unit in the "Terrestrial Ecosystem Survey for the Apache-Sitgreaves National Forests" (Laing et al., 1987, as amended).

[14] Based on site capability as defined by the specific ecological unit under consideration in the "Terrestrial Ecosystem Survey for the Apache-Sitgreaves National Forests" (Laing et al., 1987, as amended).

- Grasses, forbs, shrubs, and litter are abundant and continuous to support natural fire regimes.
- The composition, density, structure, and mosaic of vegetative conditions reduce uncharacteristic wildfire hazard to local communities and forest ecosystems.

Fine Scale Desired Conditions (less than 10 acres)

- Rare or unique plant communities (e.g., agaves, Chihuahuan pine) are intact and persisting.
- Herbaceous vegetation amount and structure (e.g., plant density, height, litter, seed heads) provides habitat to support wildlife and prey species.
- Some isolated infestations of mistletoe provide for a diversity of habitat components (e.g., food, nesting, cover) for a variety of species such as owls, squirrels, and some birds and insects.

Standards for All PNVTs

- Across the planning unit, within each PNVT, vegetation management activities shall be designed to maintain or move plant composition toward a moderate to high plant community similarity[15] as compared to site potential.
- Vegetation treatments shall include measures to reduce the potential for introduction of invasive plants and animals and damage from nonnative insects and diseases.

Guidelines for All PNVTs

- During project design and implementation, precautions should be taken to reduce the potential for damage to residual vegetation in order to prevent premature or excessive mortality.
- Landscape scale restoration projects should be designed to spread treatments out spatially and/or temporally within the project area to reduce implementation impacts and allow reestablishment of vegetation and soil cover.
- Restoration methods, such as thinning or prescribed fire, should leave a mosaic of untreated areas within the larger treated project area to allow recolonization of treated areas by plants, small mammals, and insects (e.g., long-tailed voles, fritillary butterflies).
- Wildland fires may be used to meet desired resource conditions, maintain or promote desired vegetation species, and enable natural fires to return to their historic role.
- Insect and disease infected trees should be removed to prevent spread beyond endemic levels.

[15] Moderate similarity to the desired plant community begins at 34 percent; high similarity to the desired plant community begins at 67 percent. Similarity is described in FSH 2090.11 (1.47a - Ecological Status). Current methodology for estimating similarity is found in the Region 3 Rangeland Analysis and Management Training Guide, July 1999 (revised November 2013).

- Green slash and decked logs should be managed, in a timely manner, to make them unfavorable bark beetle habitat.
- Project implementation should include bark beetle monitoring within and adjacent to all active slash-creating projects to help prevent beetle outbreak.
- Projects should include quantitative and/or qualitative objectives for implementation monitoring and effectiveness monitoring to assist in moving toward or maintaining desired conditions.

Management Approaches for All PNVTs

Vegetation treatments are concentrated in priority 6th level HUC watersheds and areas identified in community wildfire protection plans (CWPPs), including regular treatments to maintain desired conditions in the Community-Forest Intermix Management Area[16]. The PNVTs (see specific PNVTs and appendix B) are validated at the project or activity level for application of plan desired conditions. The Apache-Sitgreaves NFs work to update and refine the terrestrial ecosystem survey.

As treatments are planned, forest managers consider native species resiliency in order to avoid loss of genetic diversity, including the widespread elimination of a particular native woody species and/or certain genotypes/phenotypes of any species. Local plant materials are collected, stored, propagated, and used to provide for continued genetic diversity and to respond to changing environmental conditions. Those species lacking in the tree seed inventory, as well as other key plant species at risk from uncharacteristic disturbance, are collected as opportunities arise from a variety of locations within their natural ranges.

Managers also consider the impacts of insects and disease. Appropriate cutting methods and/or fire are used to manage mistletoe and other insect and disease infestations. Large project areas (generally larger than 500 to 1,000 acres) creating green slash for 2 or more consecutive years are generally spaced over 2 miles apart from each other to help prevent bark beetle population buildup. To further reduce bark beetle occurrence, managers attempt to effectively treat slash within approximately 30 days of slash creation.

Related Plan Content for All PNVTs

See the following sections: Air, Soil, Wildlife and Rare Plants, Landscape Scale Disturbance Events, Motorized Opportunities, Forest Products, Wildland Fire Management, and Community-Forest Intermix.

Riparian Areas

Background for Riparian Areas

Riparian areas include plant communities associated with springs, seeps, streams, ponds, lakes, and other wet areas. These areas collect and transport water, soil, and organic material from upslope and upstream. They make up the most biologically productive and diverse components of

[16] The Community-Forest Intermix Management Area makes up a portion of the wildland-urban interface. See chapter 3 for information on management areas.

the forests' ecosystems. Fish, most wildlife, and many plant species depend on riparian areas for their existence. Riparian areas provide important habitat connectivity for terrestrial and aquatic species. Some wildlife, such as otter and beaver, historically contributed to the maintenance of riparian areas.

Riparian areas are important because water is rare in the Southwest. Four specific PNVTs occur on the Apache-Sitgreaves NFs: montane willow riparian forest, cottonwood-willow riparian forest, mixed broadleaf deciduous riparian forest, and wetland/cienega. These riparian areas cover less than 3 percent of the forests; however, they represent a major portion of the riparian areas within the ecoregion[17]. Because they cover such a small area and have a shallow saturated zone beneath them, they are vulnerable to disturbance. The interface between riparian areas and uplands provides important wildlife habitat and helps filter sediment. Compared to surrounding uplands, riparian areas have characteristics (e.g., surface water, saturated soils) that reduce fire frequency and fire intensity.

Montane willow riparian forest PNVT, at roughly 4,800 acres, is found along approximately 1,130 miles of rivers and streams starting at about 5,000 feet in elevation and extending up to approximately 11,000 feet. At lower elevations, this riparian PNVT can be found along perennial streams and seasonal or intermittent drainages. Dominant woody vegetation includes a variety of willows such as Geyer and Bebb, narrowleaf cottonwood, and Arizona alder. Shrubs include skunkbush sumac, chokecherry, and red osier dogwood. An assortment of herbaceous species is usually present. At higher elevations, montane willow riparian areas are found along stream banks, seeps, fens, and isolated springs. Dominant woody vegetation includes a variety of willows, thinleaf alder, and currant. In many high elevation sites, nonnative Kentucky and Canada bluegrasses are the dominant herbaceous species.

Cottonwood-willow riparian forest PNVT covers approximately 15,900 acres and is typically found at elevations from 5,500 to 7,500 feet along roughly 800 miles of rivers and streams in wider valley bottoms. This riparian PNVT is found primarily on the Sitgreaves NF. Dominant woody species include narrowleaf cottonwood and a variety of willows such as Geyer and Goodding's. An assortment of herbaceous species is usually present.

Mixed broadleaf deciduous riparian forest PNVT, at roughly 9,700 acres, is found along approximately 860 miles of rivers and streams. Elevations start around 3,500 feet and range up to approximately 6,500 feet. The vegetation is a mix of riparian woodlands and shrublands with a variety of vegetation associations. The dominant vegetation depends on a mixture of site-specific characteristics including elevation, soil type, stream gradient, and depth to groundwater. For example, one vegetation association is dominated by bigtooth maple with mixed stands of Emory oak and scattered conifers (pines and junipers). Other sites can be dominated by a mixture of woody species including boxelder, Fremont cottonwood, Arizona sycamore, velvet ash, Arizona walnut, desert willow, and true willow species (e.g., Goodding's), as well as numerous shrub, grass, and forb species.

[17] Ecoregion sections and subsections are units in the National Hierarchy of Ecological Units ranging in size from 13 million acres (section) down to 10,000 acres (subsection) that describe areas of similar environmental and biological features. The Apache-Sitgreaves NFs is located in the White Mountains-San Francisco Peaks-Mogollon Rim ecoregion section.

Wetland/cienega riparian areas generally occur between 5,500 and 11,000 feet elevation and cover roughly 17,900 acres. This PNVT is associated with perennial springs, seeps or headwater streams, bogs, and fens where groundwater intersects the surface and creates pools of standing water, sometimes with channels flowing between pools. Wetland/cienegas may also include high elevation meadows with subsurface flows. Vegetation composition is diverse, varies with elevation, and includes saltgrass, bentgrasses, sacaton, and bog alkaligrass at lower elevations and tufted hairgrass, mannagrasses, sedges, and spikerushes, among others, at middle and higher elevations.

All of the riparian PNVTs' overstory vegetation, except for the cottonwood-willow riparian forest PNVT, are considered departed from reference conditions. Most of this departure has occurred in response to past grazing and water diversions for agriculture. Many riparian areas are not in proper functioning condition (PFC). Changes in watershed conditions have resulted in altered canopy cover, including a loss of mature trees and saplings; a change in vegetation species composition, including a shift toward increasing conifer dominance; and a reduction in the amount and composition of herbaceous vegetation. In addition, riparian tree species are not successfully reproducing in many areas. During drought conditions, riparian areas are more susceptible to damage from wildfire than under normal conditions.

Based on range conditions and ecological status, the majority (approximately 59 percent) of herbaceous understory vegetation within the riparian forested PNVTs is highly to severely departed from desired conditions. The ecological status of herbaceous understory vegetation within the wetland/cienega riparian areas is split, nearly equally, between low to moderately departed and high to severely departed from desired conditions.

The montane willow, cottonwood-willow, and mixed broadleaf deciduous riparian forests are generally within the historic fire regime. The wetland/cienega's fire regime is moderately departed. Additional information about overstory and understory vegetation conditions can be found in appendix B.

Because riparian areas are important to a large number of wildlife, no single species could adequately serve as a management indicator species for analyzing impacts to biological diversity. Instead, two riparian areas were selected as an "ecological indicator" or EI for forest plan monitoring to provide an indirect way to estimate how forest management and activities influence associated species. The montane willow and the cottonwood-willow riparian forested PNVTs were selected[18] as the riparian EI.

Desired Conditions for Riparian Areas

Landscape Scale Desired Conditions (10,000 acres or greater)

- Natural ecological disturbances (e.g., flooding, scouring) promote a diverse plant structure consisting of herbaceous, shrub, and tree species of all ages and size classes necessary for the recruitment of riparian-dependent species.

[18] For more information, see the "Wildlife and Rare Plants" section, chapter 3 of the Programmatic Final Environmental Impact Statement for the Apache-Sitgreaves National Forests Land Management Plan (Forest Service, 2014).

- Riparian-wetland conditions maintain water-related processes (e.g., hydrologic, hydraulic, geomorphic). They also maintain the physical and biological community characteristics, functions, and processes.

Mid-Scale Desired Conditions (100 to 1,000 acres)

- Stream (lotic) riparian-wetland areas have vegetation, landform, and/or large coarse woody debris to dissipate stream energy associated with high water flow.
- Streams and their adjacent floodplains are capable of filtering, processing, and storing sediment; aiding floodplain development; improving floodwater retention; and increasing groundwater recharge.
- Vegetation and root masses stabilize stream banks, islands, and shoreline features against the cutting action of water.
- Ponding and channel characteristics provide habitat, water depth, water duration, and the temperatures necessary for maintaining populations of riparian-dependent species and for their dispersal.
- Beavers occupy capable stream reaches and help promote the function and stability of riparian areas.
- Lentic riparian areas (e.g., wet meadows, fens, bogs) have vegetation and landform present to dissipate wind action, wave action, and overland flow from uplands.
- Wetland riparian areas are capable of filtering sediment and aiding floodplain development that contribute to water retention and groundwater recharge.
- Willows (e.g., Bebb, Geyer, Arizona, Goodding's) are reproducing with all age classes present, where the potential exists.
- The spatial extent of wetlands is maintained[19].
- Sedimentation and soil compaction from forest activities (e.g., vehicle use, recreation, livestock grazing) do not negatively impact riparian areas.
- Riparian vegetation consists mostly of native species that support a wide range of vertebrate and invertebrate species and are free of invasive plant and animal species.
- Riparian-obligate species within wet meadows, around springs and seeps, along stream banks, and active floodplains provide sufficient[14]. vegetative ground cover (herbaceous vegetation, litter, and woody riparian species) to protect and enrich soils, trap sediment, mitigate flood energy, stabilize stream banks, and provide for wildlife and plant needs.
- Diversity and density of riparian forest vegetation provides for breeding, escape, hiding, and resting cover for wildlife and provides travel ways between other habitat areas and seasonal ranges.

[19] The spatial extent of wetlands is delineated in the 2011 RMAP (Regional Riparian Mapping Project) found in the forests' GIS database.

Fine Scale Desired Conditions (less than 10 acres)

- The ecological function of riparian areas is resilient to animal and human use.
- Riparian soil productivity is optimized as described by the specific TES map unit[14] under consideration as indicated by the vigor of the vegetation community. Based on species composition, ungrazed plant heights[20] range from 10 inches to 36 inches.
- Floodplains and adjacent upland areas provide diverse habitat components (e.g., vegetation, debris, logs) as necessary for migration, hibernation, and brumation (extended inactivity) specific to the needs of riparian-obligate species (e.g., New Mexico meadow jumping mouse, Arizona montane vole, narrow-headed gartersnake).
- Large coarse woody debris provides stability to riparian areas and stream bottoms lacking geologic control (e.g., bedrock) or geomorphic features (e.g., functioning floodplains, stream sinuosity, width/depth ratio).
- Vegetation is structurally diverse, often dense, providing for high bird species diversity and abundance, especially neotropical migratory birds. It includes large trees and snags in the cottonwood-willow and mixed broadleaf deciduous riparian forests to support species such as beaver, yellow-billed cuckoo, bald eagles, Arizona gray squirrel, and various bat species.

Objectives for Riparian Areas

- Annually, move 200 to 500 acres toward desired composition, structure, and function of streams, floodplains, and riparian vegetation.
- Within the planning period, relocate, repair, improve, or decommission a minimum of 4 miles of National Forest System roads or trails that add sediment to streams, damage riparian vegetation, erode stream banks, cause gullies, and/or compact floodplain soils.
- Annually, remove an average of 2 miles of unauthorized roads or trails that add sediment to streams, damage riparian vegetation, erode stream banks, cause gullies, and/or compact floodplain soils.
- Within the planning period, enhance or restore 5 to 25 wet meadows, springs, seeps, or cienegas to proper hydrologic function and native plant and animal species composition.
- Annually, work with partners to reduce animal damage to native willows and other riparian species on an average of 5 miles of riparian habitat.

Guidelines for Riparian Areas

- Ground-disturbing projects (including prescribed fire) which may degrade long term riparian conditions should be avoided.

[20] Plant height source material: Vine, 1960; Hermann, 1970 and 1975; Hitchcock and Chase, 1971; McDougall, 1973; Correll and Correll, 1975; Gould, 1977; Martin and Hutchins, 1980; Benson and Darrow, 1981; Hickman, 1993; Cronquist et al., 1997; Ruyle and Young, 1997; Welsh et al., 1997; Hurd et al., 1998; Barkworth et al., 2003 and 2007; Flora of North America, 2008; and Springer et al., 2009.

- Wet meadows, springs, seeps and cienegas should not be used for concentrated activities (e.g., equipment storage, forest product or mineral stockpiling, livestock handling facilities, special uses) that cause damage to soil and vegetation.
- Active grazing allotments should be managed to maintain or improve to desired riparian conditions.
- Storage of fuels and other toxicants should be located at least 100 feet outside of riparian areas to prevent spills that could impair water quality or harm aquatic species.
- Equipment should be fueled or serviced at least 100 feet outside of riparian areas to prevent spills that could impair water quality or harm aquatic species.
- Construction or maintenance equipment service areas should be located at least 100 feet from riparian areas, and treated to prevent gas, oil, or other contaminants from washing or leaching into streams.

Management Approaches for Riparian Areas

Riparian areas that are emphasized for treatment occur within priority 6th level HUC watersheds or areas that have native fish and aquatic species concerns. The forests currently use Proper Functioning Condition methodology (USDI Bureau of Land Management, 1998 and 1999) to inventory riparian condition. Landscape scale restoration is expected to improve riparian conditions through improved hydrologic function of uplands. Riparian conditions may be improved by such techniques as removing non-riparian species, planting or restoring native species, stabilizing or eliminating roads, encouraging beaver colonization, or constructing fencing. Treatments may include restoration of hardwood and cottonwood galleries, restoration of upland conditions by removing encroaching trees and/or reducing tree densities, and restoration of infrequent fire. Large human constructed dams may be altered or removed to restore and/or improve riparian and wetland functionality. The forests maintain an inventory and assessment of wetlands and other groundwater-dependent resources such as springs, seeps, bogs and fens.

The Apache-Sitgreaves NFs work with the Arizona Game and Fish Department (AZGFD) minimize wildlife impacts to riparian vegetation and structure and to develop project design criteria to protect important habitat features such as springs, bogs, seeps, and fens. In high impact areas, partnerships may be formed to construct and maintain exclosure fencing. The Apache-Sitgreaves NFs work with the U.S. Fish and Wildlife Service to update existing conservation agreements (e.g., Arizona willow) and develop new ones as needed.

Related Plan Content for Riparian Areas

See the following sections: Overall Ecosystem Health, Soil, Water Resources, Aquatic Habitat and Species, All PNVTs, Wildlife and Rare Plants, Dispersed Recreation, Motorized Opportunities, Nonmotorized Opportunities, and Wildland Fire Management.

Forests: All Forested PNVTs

Background for Forests: All Forested PNVTs

The following objectives, guidelines, and management approaches apply to ponderosa pine, dry mixed conifer, wet mixed conifer, spruce-fir, and aspen in addition to the specific direction listed in those sections. Forested PNVTs total approximately 946,000 acres.

Desired Conditions for Forests: All Forested PNVTs

See the desired conditions for ponderosa pine, dry mixed conifer, wet mixed conifer, spruce-fir, and aspen.

Objectives for Forests: All Forested PNVTs

- Annually, treat 5,000 to 35,000 acres to reduce tree densities, restore natural fire regimes, promote species habitat and ecosystem health, reduce fire hazard, maintain desired conditions, initiate recovery from uncharacteristic disturbance, and provide forest products, leaving a desired mix of species with the range of desired densities that are resilient to changing climatic conditions.

Standards for Forests: All Forested PNVTs

- Regulated timber harvest activities shall occur only on those lands classified as suitable for timber production.
- If individual harvest openings created by even-aged silvicultural practices are proposed that would exceed 40 acres, then National Forest Management Act (NFMA) requirements regarding public notification and regional forester approval shall be followed. These requirements do not apply to the size of areas harvested because of natural catastrophic conditions such as, but not limited to, fire, insect and disease attacks, or windstorms.
- On lands suitable for timber production, timber harvest and wildland fire intended to create openings for tree regeneration shall only be used when there is reasonable assurance of restocking within 5 years after final regeneration harvest. Restocking level is prescribed in a site-specific silviculture prescription for a project treatment unit and is determined to be adequate depending on the objectives and desired conditions for the plan area. In some instances, such as when lands are harvested or prescribed burned to create or maintain openings for firebreaks and vistas, it is appropriate not to restock.

- On lands suitable for timber production, even-aged stands shall have reached or surpassed culmination of mean annual increment (95 percent of culmination of mean annual increment of growth, as measured by cubic volume) prior to regeneration harvest, unless the following conditions have been identified during project development: (1) when such harvesting would assist in reducing fire hazard within the wildland-urban interface, or (2) when harvesting of stands will trend landscapes toward vegetation desired conditions (e.g., uneven-aged structure).
- Harvesting systems shall be selected based on their ability to meet desired conditions and not strictly on their ability to provide the greatest dollar return.
- Clearcutting shall be used only where it is the optimum method for meeting desired conditions.

Guidelines for Forests: All Forested PNVTs

- Where current forests are lacking proportional representation of late seral states and species composition on a landscape scale, old growth characteristics should be retained or encouraged to the greatest extent possible within the scope of meeting other desired conditions (e.g., reduce impacts from insects and disease, reduce the threat of uncharacteristic wildfire).
- Healthy southwestern white pine should be retained to maintain the wide range of genetic variability that contributes to resistance against the nonnative white pine blister rust disease.
- Tree species that are less susceptible to root disease should be retained within areas of root disease infection to reduce spread of disease.
- On single species dominated sites, uneven-aged management may be used where less than 20 percent of the host tree species—or less than 25 percent of the area—is infected by dwarf mistletoe. Thinning and under-burning may be used to keep dwarf mistletoe levels from increasing. Even-aged management or deferral should be considered when greater than 20 percent of the host species, or 25 percent of the area, is infected with dwarf mistletoe.
- On single species dominated sites, thinning should not be attempted where more than 80 percent of the host species—or 90 percent of the area—is infected with dwarf mistletoe. Regeneration and/or deferral may be used in these cases. However, in the Community-Forest Intermix Management Area additional treatment options may be used.
- On mixed species dominated sites, even-aged management or deferral should be used instead of uneven-aged management where more than 50 percent of conifer trees (excluding white fir) are infected by dwarf mistletoe.
- When thinning dwarf mistletoe infected sites, as much mistletoe should be removed as possible without sacrificing the healthiest, most desirable trees for the particular site (in some situations, this may involve retaining some trees in the upper canopy that are lightly infected to meet multiple resource objectives).

- Where a seed cut treatment (even-aged method to promote natural seedling establishment) is applied for dwarf mistletoe control, it should be followed within 10 years of seedling establishment by a final removal treatment or other effective means to prevent further infection.
- Where a site-specific analysis indicates the need to reduce fire-kill of desired residual trees, fuel continuity and/or loading should be reduced before use of prescribed fire.
- Trees, snags, and logs immediately adjacent to active red squirrel cone caches, Abert's squirrel nests, and raptor nests should be retained to maintain needed habitat components and provide tree groupings.
- Hiding cover, approach cover (by waters), and travel corridor cover should be provided where needed by wildlife.

Management Approaches for Forests: All Forested PNVTs

Forest treatments occur predominantly in ponderosa pine and dry and wet mixed conifer. There is an emphasis on restoring natural fire regimes, providing wildlife species habitat needs, obtaining sustainable forest products, and/or achieving ecosystem health within priority 6th level HUC watersheds. Treatment methods (see appendix B) may include wildland fire, fencing, mechanized and hand thinning, planting, chemical treatments, and other silvicultural treatments. Cone collection, tree planting, and natural regeneration are used to ensure the perpetuation of desired tree species. Mexican spotted owl and northern goshawk are management indicator species (MIS) of forest density and structure. The treatment objective listed above would contribute to species viability.

When salvaging timber where high severity fire occurred, an adequate number of trees for snag recruitment and coarse woody debris would be left to maintain long term soil productivity and to meet wildlife needs. The desired amount of snags and debris is described in the specific forested PNVT desired conditions section.

Considerations are made so that remaining trees following thinning projects are less subject to windthrow. To help prevent windthrow, project managers consider (1) soils with windthrow potential, (2) species silvics (windthrow prone), and (3) avoiding cuts which would reduce existing tree density by generally more than 66 percent in one entry, unless the remaining trees are kept in windfirm groups.

Figure 4. Prescribed fire

The use of wildland fire to burn large areas is expected to be an important tool to manage some aspen and insect and disease populations. Uneven-aged management techniques are used primarily, and some even-aged management is used especially when managing species such as aspen and spruce. Even-aged treatments may be applied in the short term for forest health concerns (e.g., heavy dwarf mistletoe infections) to facilitate a transition to uneven-aged

management. The Apache-Sitgreaves NFs work with partners to reduce browse impacts on woody species.

Related Plan Content for Forests: All Forested PNVTs

See the following sections: All PNVTs, Forests: Ponderosa Pine, Forests: Dry Mixed Conifer, Forests: Wet Mixed Conifer, Forests: Spruce-Fir, Forests: Aspen, Landscape Scale Disturbance Events, Forest Products, Wildland Fire Management, and Community-Forest Intermix Management Area.

Forests: Ponderosa Pine

Background for Forests: Ponderosa Pine

Ponderosa pine at approximately 602,200 acres represents the largest PNVT on the Apache-Sitgreaves NFs. This PNVT generally occurs at elevations ranging from 6,000 to 9,000 feet. It is dominated by ponderosa pine and commonly includes other species such as Gambel oak, New Mexico locust, and at lower elevations and more southerly aspects, juniper, and piñon. Occasionally, species such as quaking aspen (aspen), southwestern white pine, Rocky Mountain Douglas-fir, white fir, and blue spruce may be present and may occur as individual trees or in small groups at higher elevations and more northerly aspects. This PNVT sometimes appears savanna like, with extensive areas of grasses, forbs and occasional shrubs forming variably-sized interspaces in between individual trees, small clumps, and groups of trees. Approximately 6,000 acres of aspen are scattered across this PNVT.

This PNVT's overstory is currently (post-Wallow Fire) severely departed from reference conditions. There are too many stands in all diameter classes with a closed canopy characteristic, and there are too few large to very large size trees with an open canopy character. The majority (85 percent) of the herbaceous understory vegetation within ponderosa pine forest is highly to severely departed from desired conditions. Approximately 9 percent of this PNVT was reset to an early developmental state because of the 2011 Wallow Fire. The natural fire regime is also severely departed from reference conditions. Historically, fire burned relatively frequently (every 2 to 17 years) and at low intensities that kept the forest open with abundant herbaceous cover.

Some areas that appear to be ponderosa pine forest are actually historic montane/subalpine or Great Basin grasslands that have been encroached by conifer species.

Desired Conditions for Forests: Ponderosa Pine

Landscape Scale Desired Conditions (10,000 acres or greater)

- The ponderosa pine forest is a mosaic of structural states ranging from young to old trees. Forest structure is variable but uneven-aged and open in appearance. Sporadic areas of even-aged structure may be present on 10 percent or less of the landscape to provide structural diversity.

- The forest arrangement consists of individual trees, small clumps, and groups of trees with variably-sized interspaces of grasses, forbs, and shrubs. Vegetation associations are similar to reference conditions. The size, shape, and number of trees per group and the number of groups per area vary across the landscape. Tree density may be greater in some locations, such as north-facing slopes and canyon bottoms.
- The ponderosa pine forest is composed predominantly of vigorous trees, but declining, top-killed, lightning-scarred, and fire-scarred trees provide snags and coarse woody debris. Snags and coarse woody debris are well distributed throughout the landscape. Ponderosa pine snags are typically 18 inches or greater in diameter and average 1 to 2 per acre.
- Coarse woody debris, including logs, ranges from 3 to 10 tons per acre. Logs average 3 per acre within the forested area of the landscape.
- Where it naturally occurs, Gambel oak is present with all age classes represented. It is reproducing to maintain or expand its presence on capable sites across the landscape. Large Gambel oak snags are typically 10 inches or larger in diameter and are well distributed.
- Grasses, forbs, shrubs, needles, leaves, and small trees support the natural fire regime. The larger proportion (60 percent or greater) of soil cover is composed of grasses and forbs as opposed to needles and leaves.
- Old growth occurs throughout the landscape, in small, discontinuous areas consisting of clumps of old trees, or occasionally individual old trees. Other old growth components are also present including dead trees (snags), downed wood (coarse woody debris), and/or structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- Frequent, low to mixed severity fires (fire regime I), occurring approximately every 2 to 17 years, are characteristic in this PNVT.

Mid-Scale Desired Conditions (100 to 1,000 acres)

- Ponderosa pine forest is characterized by variation in the size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The more biologically productive sites contain more trees per group and more groups per area, resulting in less space between groups. Interspaces typically range from 10 percent in more biologically productive sites to 70 percent in the less productive sites. Tree density within forested areas ranges from 20 to 80 square feet basal area per acre.
- The tree group mosaic composes an uneven-aged forest with all age classes, size classes, and structural stages present. Occasionally, patches of even-aged forest structure are present (less than 50 acres). Disturbances sustain the overall age and structural distribution.
- Fires burn primarily on the forest floor and do not spread between tree groups as crown fire.
- Forest structure in the wildland-urban interface (WUI) may have smaller, more widely spaced groups of trees than in the non-WUI areas.

- Northern goshawk post-fledging family areas (PFAs) may contain 10 to 20 percent higher basal area in mid-aged to old tree groups than northern goshawk foraging areas and the surrounding forest.
- Northern goshawk nest areas have forest conditions that are multi-aged and dominated by large trees with relatively denser canopies than the surrounding forest.

Fine Scale Desired Conditions (less than 10 acres)

- Trees typically occur in irregularly-shaped groups and are variably spaced with some tight clumps. Tree crowns in the mid- to old-aged groups are interlocking or nearly interlocking providing for species such as Abert's squirrel.
- Interspaces surrounding tree groups are variably shaped and composed of a grass, forb, and shrub mix. Some may contain individual trees or snags.
- Trees within groups are of similar or variable ages and may contain species other than ponderosa pine. Tree groups are typically less than 1 acre and average ½ acre. Mid- to old-aged tree groups consist of approximately 2 to 40 trees with interlocking canopies.
- Where Gambel oak occurs, the majority are single trunk trees over 8 inches in diameter with full crowns.

Guidelines for Forests: Ponderosa Pine

- Where Gambel oak or other native hardwood trees and shrubs are desirable to retain for diversity, treatments should improve vigor and growth of these species.
- Where consistent with project or activity objectives, canopy cover should be retained on the south and southwest sides of small, existing forest openings that are naturally cooler and moister. These small (generally one-tenth to one-quarter acre) shaded openings provide habitat conditions needed by small mammals, plants, and insects (e.g., Merriam's shrew, Mogollon clover, four-spotted skipperling butterfly). Where these openings naturally occur across a project area, these conditions should be maintained on an average of 2 or more such openings per 100 acres.

Related Plan Content for Forests: Ponderosa Pine

See the following sections: Overall Ecosystem Health, Soil, All PNVTs, Forests: All Forested PNVTs, Forests: Aspen, Wildlife and Rare Plants, Wildland Fire Management, and Community-Forest Intermix Management Area.

Forests: Dry Mixed Conifer

Background for Forests: Dry Mixed Conifer

The forests contain two mixed conifer forested PNVTs. The dry mixed conifer PNVT burns on a more frequent cycle than the wet mixed conifer PNVT, due to the presence of shade intolerant (fire and dry site adapted) species in the mix.

Dry mixed conifer, covering approximately 147,900 acres, typically occurs between the ponderosa pine and wet mixed conifer forests. Dry mixed conifer generally occurs at elevations between 7,000 and 10,000 feet on flat ridgetops and upper slopes of drainages and knolls. Species vary in relation to elevation and moisture availability and are mainly shade intolerant trees. In lower elevations and drier areas, Rocky Mountain Douglas-fir, Gambel oak, ponderosa pine, piñon, and juniper may codominate. In higher elevations and moister areas, ponderosa pine may codominate with Rocky Mountain Douglas-fir, aspen, white fir, southwestern white pine, and Rocky Mountain juniper. The understory can be composed of a wide variety of shrubs, grasses, sedges, rushes, and forbs depending on the soil type, aspect, elevation, disturbance history, and other factors. Over 14,000 acres of aspen are scattered across this PNVT.

This PNVT's overstory is currently (post-Wallow Fire) highly departed from reference conditions. The forest composition has shifted toward more shade tolerant species that are not adapted to fire, such as true firs. It also has too many stands with a closed canopy characteristic, and there is an underrepresentation of medium to very large size trees with an open canopy character. The majority (approximately 78 percent) of the herbaceous understory vegetation within the dry mixed conifer forest is highly to severely departed from desired conditions. Approximately 25 percent of this PNVT was reset to an early developmental state because of the 2011 Wallow Fire. The natural fire regime is also severely departed from reference conditions. Historically, fire burned relatively frequently (every 10 to 22 years) and at low intensities. This historic regime kept the forest open and maintained fire-resistant species and an abundant herbaceous understory.

Desired Conditions for Forests: Dry Mixed Conifer

Landscape Scale Desired Conditions (10,000 acres or greater)

- The dry mixed conifer forest is a mosaic of conditions composed of structural states ranging from young to old trees. Forest structure and density are similar to ponderosa pine forest. Forest appearance is variable but uneven-aged and open. Sporadic areas of even-aged structure may be present on 10 percent or less of the landscape to provide structural diversity.
- The forest arrangement consists of small clumps and groups of trees with variably-sized interspaces of grass, forb, and shrub vegetation associations similar to reference conditions. Size, shape, number of trees per group, and number of groups per area are variable across the landscape. Where they naturally occur, groups of Gambel oak are healthy and maintained or increased. Tree density may be greater in some locations, such as north-facing slopes and canyon bottoms.
- The dry mixed conifer forest is composed predominantly of vigorous trees, but declining, top-killed, lightning-scarred, and fire-scarred trees provide snags and coarse woody debris. Snags and coarse woody debris are well distributed throughout the landscape. Snags are typically 18 inches in diameter or greater and average 3 per acre.
- Coarse woody debris, including logs, ranges from 5 to 15 tons per acre. Logs average 3 per acre within the forested area of the landscape.
- Southwestern white pine is present with the ability to reproduce on capable sites.

- Grasses, forbs, shrubs, needles, leaves, and small trees support the natural fire regime. The larger proportion (60 percent or greater) of soil cover is composed of grasses and forbs as opposed to needles and leaves.
- Old growth occurs throughout the landscape, in small, discontinuous areas consisting of clumps of old trees, or occasionally individual old trees. Other old growth components are also present including dead trees (snags), downed wood (coarse woody debris), and/or structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- Frequent, low to mixed severity fires (fire regime I) occurring every 10 to 22 years are characteristic in this PNVT.

Mid-Scale Desired Conditions (100 to 1,000 acres)

- The dry mixed conifer forest is characterized by a variety of size and number of tree groups depending on elevation, soil type, aspect, and site productivity. The more biologically productive sites contain more trees per group and more groups per area, resulting in less space between groups. Interspaces typically range from 10 percent in more biologically productive sites to 50 percent in less productive sites. Tree density within forested areas ranges from 30 to 100 square feet basal area per acre.
- The mosaic of tree groups is composed of uneven-aged forest. All age classes and structural stages are present. Occasionally, there are small patches (less than 50 acres) of even-aged forest present. Disturbances sustain the overall age and structural distribution.
- Fire burns primarily on the forest floor and does not spread between tree groups as crown fire.
- Forest structure in the wildland-urban interface (WUI) may have smaller, more widely spaced groups of trees than in the non-WUI areas.
- Northern goshawk post-fledging family areas (PFAs) may contain 10 to 20 percent higher basal area in mid-aged to old tree groups than northern goshawk foraging areas and the surrounding forest.
- Northern goshawk nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than the surrounding forest.

Fine Scale Desired Conditions (less than 10 acres)

- Trees typically occur in irregularly-shaped groups and are variably spaced with some tight clumps. Tree crowns in the mid- to old-aged groups are interlocking or nearly interlocking providing for species such as red squirrel.
- Interspaces surrounding tree groups are composed of a grass, forb, and shrub mix. Some may contain individual trees or snags.
- Trees within groups are of similar or variable ages and one or more species. Tree group sizes typically are less than 5 acres, but often less than 1 acre, and at the mature and old stages consist of approximately 2 to 50 trees.

- Where Gambel oak occurs, the majority are single trunk trees over 8 inches in diameter with full crowns.

Guidelines for Forests: Dry Mixed Conifer

- Where Gambel oak or other native hardwood trees and shrubs are desirable to retain for diversity, treatments should improve vigor and growth of these species.
- Where consistent with project or activity objectives, canopy cover should be retained on the south and southwest sides of small, existing forest openings that are naturally cooler and moister. These small (generally one-tenth to one-quarter acre) shaded openings provide habitat conditions needed by small mammals, plants, and insects (e.g., Merriam's shrew, Mogollon clover, four-spotted skipperling butterfly). Where these openings naturally occur across a project area, these conditions should be maintained on an average of 2 or more such openings per 100 acres.

Related Plan Content for Forests: Dry Mixed Conifer

See the following sections: Overall Ecosystem Health, Soil, All PNVTs, Forests: All Forested PNVTs, Forests: Aspen, Wildlife and Rare Plants, Wildland Fire Management, and Community-Forest Intermix Management Area.

Forests: Wet Mixed Conifer

Background for Forests: Wet Mixed Conifer

The forests contain two mixed conifer forested PNVTs. The wet mixed conifer forest PNVT burns on a less frequent cycle than the dry mixed conifer forest PNVT.

Wet mixed conifer, at approximately 178,000 acres, occurs at elevations between 8,500 to 10,000 feet on gentle to very steep slopes. Tree species composition varies depending on seral state, elevation, and moisture availability. This PNVT can be composed of early seral species such as aspen, Rocky Mountain Douglas-fir, New Mexico locust, southwestern white pine, and late seral species such as maple, white fir, and blue spruce. Ponderosa pine may be a minor component in some locations or absent. The absence of Engelmann spruce distinguishes this PNVT from spruce-fir. This PNVT has an understory of a wide variety of shrubs, grasses, and forbs depending on soil type, aspect, elevation, disturbance, and other factors. Herbaceous species may include, but are not limited to, red baneberry, starry false Solomon's seal, and subalpine lupine. Over 50,000 acres of aspen are scattered across this PNVT.

This PNVT's overstory is currently (post-Wallow Fire) highly departed from reference conditions. There is a lack of aspen regeneration and too few large to very large shade tolerant trees with a closed canopy characteristic. Approximately 35 percent of this PNVT was reset to an early developmental state because of the 2011 Wallow Fire. The majority (approximately 74 percent) of the herbaceous understory vegetation within the wet mixed conifer forest is highly to severely departed from desired conditions.

The natural fire regime is also moderately departed from reference conditions. Historic fire regimes were typically of mixed severity fires (every 35 to 50 years) and occasional high severity,

stand replacing, crown fires (every 120 to 400 or more years). Natural ecological disturbances in this PNVT typically occur at two spatial and temporal scales: large scale infrequent (mostly fire) and small scale frequent (e.g., fire, insects, disease, wind).

Desired Conditions for Forests: Wet Mixed Conifer

Landscape Scale Desired Conditions (10,000 acres or greater)

- The wet mixed conifer forest is a mosaic of structural stages and seral states ranging from young to old trees. The landscape arrangement is an assemblage of variably-sized and aged groups and patches of trees and other vegetation associations similar to reference conditions.
- All seral states are present across the landscape, with each state characterized by distinct dominant species composition, biological and physical conditions, and enough of each state is present to develop into the next state progressively over time.
- Canopies are more closed than dry mixed conifer. An understory, consisting of native grass, forbs, and/or shrubs, is present.
- The wet mixed conifer forest is composed predominantly of vigorous trees, but declining, top-killed, lightning-scarred, and fire-scarred trees provide snags and coarse woody debris. Snags and coarse woody debris are well distributed throughout the landscape. The number of snags and logs and amount of coarse woody debris varies by seral state ranging from 8 to more than 16 tons per acre.
- Old growth occurs over large, continuous areas. Old growth components include old trees, dead trees (snags), downed wood (coarse woody debris), and/or structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- Mixed severity fire (fire regime III) is characteristic of this forest. High severity fires (fire regimes IV and V) rarely occur.

Mid-Scale Desired Conditions (100 to 1,000 acres)

- The size and number of groups and patches vary depending on disturbance, elevation, soil type, aspect, and site productivity. Patch sizes vary but are frequently hundreds of acres and rarely thousands of acres. Groups of tens of acres or less are relatively common. There is a mosaic of primarily even-aged groups and patches, which vary in size, species composition, and age. Grass, forb, and shrub openings created by disturbances may compose 10 to 100 percent of the area depending on the type of disturbance.
- Uneven-aged groups and patches, comprising about 20 percent of this PNVT, provide for species such as the black bear and red-faced warbler that need multistoried canopies with dense low- to mid-canopy layers.
- Tree density ranges from 30 to 180 square feet basal area per acre depending upon time since disturbance and seral states of groups and patches.
- There are 20 or more snags greater than 8 inches in diameter per acre and 1 to 5 of those snags are 18 inches or greater in diameter.

- Coarse woody debris, including logs, varies by seral state, ranging from 5 to 20 tons per acre for early-seral states; 20 to 40 tons per acre for mid-seral states; and may be as high as 35 tons per acre, or greater, for late-seral states. These conditions also provide an abundance of fungi including mushrooms and truffles used by small mammals.
- Forested PNVTs in the wildland-urban interface (WUI) are dominated by early-seral, fire-adapted species growing in an overall more open condition than the surrounding forest. These conditions result in fires that burn primarily on the forest floor and rarely spread as crown fire.
- Mixed (fire regime III) and high (fire regime IV) severity fires in this PNVT, occurring every 22 to 150 years along with other disturbances, maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling. High severity fires do not exceed patches of 1,000 acres of mortality. Other smaller disturbances occur more frequently.
- Northern goshawk post-fledging family areas (PFAs) may contain 10 to 20 percent higher basal area in mid-aged to old tree groups than northern goshawk foraging areas and the surrounding forest.
- Northern goshawk nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than the surrounding forest.

Fine Scale Desired Conditions (less than 10 acres)

- In mid-aged and older forests, trees are typically variably spaced with crowns interlocking (grouped and clumped trees) or nearly interlocking providing for species such as red squirrel. Trees within groups can be of similar or variable species and ages.
- Small openings are present as a result of disturbances (e.g., wind, disease).

Related Plan Content for Forests: Wet Mixed Conifer

See the following sections: Overall Ecosystem Health, Soil, All PNVTs, Forests: All Forested PNVTs, Forests: Aspen, Wildlife and Rare Plants, Wildland Fire Management, and Community-Forest Intermix Management Area.

Forests: Spruce-Fir

Background for Forests: Spruce-Fir

The spruce-fir forest PNVT, at approximately 17,700 acres, is found on the coldest, wettest high elevation sites (approximately 9,500 to 11,400 feet) and within cold-air drainages at lower elevations on the Apache NF portion of the forests. The majority of this forested PNVT lies within designated wilderness areas. Spruce-fir intergrades with the wet mixed conifer PNVT at lower elevations. It is dominated by Engelmann spruce but contains other species depending on elevation. The understory commonly includes currant, Scouler’s willow, honeysuckle, common juniper, huckleberry, alpine clover, and sedges. Approximately 6,000 acres of aspen are scattered across this PNVT.

This PNVT's overstory is currently (post-Wallow Fire) highly departed from reference conditions. There is a lack of aspen regeneration. There are also too few large to very large shade tolerant trees with closed canopies. Approximately 31 percent of this PNVT was reset to an early developmental state because of the 2011 Wallow Fire. The majority (approximately 76 percent) of the herbaceous understory vegetation within spruce-fir forest is low to moderately departed from desired conditions.

The natural fire regime is also moderately departed from reference conditions. Historically, principal ecological disturbance factors were insects, disease, and wind followed by infrequent high severity fires. Natural ecological disturbances in this PNVT typically occur at two temporal and spatial scales: large scale infrequent (fire, which occurred every 150 to 400 years and climate variability) and small scale frequent (e.g., fire, insects, disease, wind).

Desired Conditions for Forests: Spruce-Fir

Landscape Scale Desired Conditions (10,000 acres or greater)

- The spruce-fir forest is a mosaic of structural stages and seral states ranging from young to old trees and is composed of multiple species. The landscape arrangement is an assemblage of variably-sized and aged groups and patches of trees and other vegetation similar to reference conditions.
- Tree canopies in this forest are closed. An understory, consisting of native grass, forbs, and/or shrubs, is present in early seral states and is replaced by trees in later seral states.
- The spruce-fir forest is composed predominantly of vigorous trees, but declining top-killed, lightning-scarred, and fire-scarred trees provide snags and coarse woody debris. Snags and coarse woody debris are well distributed throughout the landscape.
- Corkbark fir is present with the ability to reproduce on late-seral sites appropriate for the species.
- Old growth occurs over large, continuous areas. Old growth components include old trees, dead trees (snags), downed wood (coarse woody debris), and/or structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- In the spruce-fir forested PNVT, mixed to high severity fires (fire regimes III and IV) occur infrequently.

Mid-Scale Desired Conditions (100 to 1,000 acres)

- The size and number of groups and patches vary depending on disturbance, elevation, soil type, aspect, and site productivity. Patch sizes vary but are mostly hundreds of acres and rarely thousands of acres. There may be frequent small disturbances resulting in groups of tens of acres or less. A mosaic of primarily even-aged groups and patches, which vary in size, species composition, and age, is present. Grass, forb, and shrub openings created by disturbances may compose 10 to 100 percent of the area depending on time since disturbances. Aspen is occasionally present in large patches.

- Uneven-aged groups and patches, comprising about 20 percent of this PNVT, provide for species such as the MacGillivray's warbler and Swainson's thrush that need multistoried canopies with dense low- to mid-canopy layers.
- Tree density ranges from 30 to 250 square feet basal area per acre, depending upon disturbance and seral states of the groups and patches.
- In general, there are 13 to 30 snags greater than 8 inches in diameter per acre and 1 to 3 of those snags are 18 inches or greater in diameter.
- Coarse woody debris, including logs, varies by seral state, ranging from 5 to 30 tons per acre for early-seral states; 30 to 40 tons per acre for mid-seral states; and 40 tons per acre or greater for late-seral states. These conditions also provide an abundance of fungi including mushrooms and truffles used by small mammals.
- The wildland-urban interface (WUI) comprises primarily grass/forb/shrub vegetation. Structures in the WUI are surrounded by grassy openings with very few or no trees. These conditions result in ground fires.
- Mixed and high severity fires (fire regime III and IV)—occurring every 150 to 400 years—along with other disturbances maintain desired overall tree density, structure, species composition, coarse woody debris, and nutrient cycling.
- Northern goshawk post-fledging family areas (PFAs) may contain 10 to 20 percent higher basal area in mid-aged to old tree groups than northern goshawk foraging areas and the surrounding forest.
- Northern goshawk nest areas have forest conditions that are multi-aged but are dominated by large trees with relatively denser canopies than the surrounding forest.

Fine Scale Desired Conditions (less than 10 acres)

- Mid-aged to old trees grow tightly together with interlocking crowns. Trees are of the same size and/or age class in early group/patch development. In late development, they may be multilayered.
- Small openings are present as a result of localized disturbances (e.g., wind, disease).

Related Plan Content for Forests: Spruce-Fir

See the following sections: Overall Ecosystem Health, Soil, All PNVTs, Forests: All Forested PNVTs, Forests: Aspen, Wildlife and Rare Plants, Wildland Fire Management, and Community-Forest Intermix Management Area.

Forests: Aspen

Background for Forests: Aspen

Aspen (quaking aspen) occurs as a species within the conifer forested PNVTs. As a species, aspen is adapted to a much broader range of environmental conditions than most plant species associated with it. This highly variable ecological community can comprise mostly aspen (roughly 24,000 acres) or aspen codominating with few to several conifer species (roughly 52,000 acres). Aspen occurs across the forested landscape as a shifting mosaic over space and time. At

lower elevations, conifers include ponderosa pine, Rocky Mountain Douglas-fir, and white fir. At middle elevations, conifers include Rocky Mountain Douglas-fir, white fir, blue spruce, southwestern white pine, and ponderosa pine. Rocky Mountain juniper can also be present. At higher elevations, conifers include Rocky Mountain Douglas-fir, southwestern white pine, subalpine fir, corkbark fir, and Engelmann spruce.

Figure 5. Ecological diversity provided by a healthy, mature aspen stand

Relatively pure aspen stands may function as natural firebreaks across the landscape, support watershed stability, and contribute to scenic landscapes. Aspen is a disturbance dependent species requiring fire, windthrow, or cutting to regenerate an overmature stand into a young stand. Without periodic fire or with high levels of herbivory, conifers will replace aspen. As a result, this type is considerably altered today and may be difficult to identify because of conifer succession. The presence of even a single aspen tree in a conifer stand provides strong evidence that the area historically supported a seral component of aspen. As a direct result of the 2011 Wallow Fire, roughly 33 percent of the aspen overstory was eliminated, and those acres are now being regenerated into the seedling/sapling size class with open canopy characteristics, largely through clonal root sprouting (additional acres, previously unoccupied may be established through seed production and seedling establishment). The majority of trees in the remaining aspen overstory are 10 inches or greater in diameter and exist in a closed canopy condition. This would indicate that most of the remaining aspen on the Apache-Sitgreaves NFs are mature to overmature trees and are being over-topped by conifers within the individual forested PNVTs.

Aspen exist as single storied or, more commonly, multistoried depending on disturbance history and local stand dynamics. Historically, aspen suckers (root sprouts) were common. Aspen stands are usually closed canopied. The understory structure may be complex with multiple shrub and herbaceous layers, or simple with just an herbaceous layer. The herbaceous layer may be dense or sparse, dominated by grasses and grass-like plants or forbs. Some of the species typically found associated with aspen include bracken fern, Arizona peavine, meadow rue, deer’s ears, yarrow, violet, paintbrush, arnica, and several grasses and sedges. Decaying coarse woody debris is common.

Aspen stands are typically moister and cooler, supporting a greater abundance of plants, fungi, invertebrates, mammals, and cavity-nesting bird species than the surrounding forest. Even small aspen groups provide this unique habitat. Aspen is second only to riparian ecosystems in biological diversity and supports more bird species than other forested areas in the Southwest. For these reasons, aspen is designated as an “ecological indicator” or EI. EIs are selected and monitored as a means to assess management effects to biological diversity; in this case, the diversity of habitats that aspen provides and the associated species.

Fire regimes for aspen are determined by the adjacent forested PNVT, with fire return intervals ranging from 2 to 20 years at low elevations in ponderosa pine, to 10 to 30 years for mixed

conifer at middle elevations, and up to 30 to 400 years for spruce-fir. Both spruce-fir and mixed conifer forested PNVTs have mixed severity fire regimes, experiencing frequent, low intensity surface fires, as well as infrequent, stand replacing crown fires. Overall, aspen is an important successional community in ponderosa pine, mixed conifer, and spruce-fir forested PNVTs. Aspen is primarily affected by fire, wind, insects, disease, pathogens, herbivores, and climate interactions.

The decline in aspen throughout its western range is an ecological concern. This declining trend has been noted for the past 50 years, but aspen mortality has become more pronounced since about 2002. Not only are trees dying, but their clonal root systems are also dying. Several factors have been hypothesized as causal agents in the decline of aspen: fire suppression, conifer competition, ungulate browsing, drought, insects, pathogens, and climate change.

Desired Conditions for Forests: Aspen

Landscape Scale Desired Conditions (10,000 acres or greater)

- Areas of aspen occur and shift across the forested landscape. They are successfully regenerating and being recruited into older and larger size classes. Size classes have a natural distribution, with the greatest number of stems in the smaller size classes.

Mid-Scale Desired Conditions (100 to 1,000 acres)

- Aspen may compose 10 to 100 percent of the area depending on disturbance (e.g., fire, insects, silvicultural treatments) in multistoried patches.
- As an early seral species, aspen reproduction and recruitment benefit from low severity surface fires in association with ponderosa pine and dry mixed conifer forested PNVTs, and mixed-severity fires in association with wet mixed conifer and spruce-fir forested PNVTs.

Objectives for Forests: Aspen

- Aspen dominated and codominated acres within forested PNVTs, representing a range of age classes, are maintained on at least 50,000 acres during the planning period.

Guidelines for Forests: Aspen

- To preclude concentrated herbivore impacts, new surface water development should not be constructed within proximity to aspen stands (approximately a quarter of a mile).
- Restoration of aspen clones should occur where aspen is overmature or in decline to maintain a sustainable presence of this species at the landscape level.
- When managing for early seral states, competing conifers should be removed from aspen stands when needed to increase aspen longevity and increase diversity of aspen age classes.

- Aspen restoration and retention efforts should include measures to ensure viability of aspen on the landscape.

Management Approaches for Forests: Aspen

The forests work with the AZGFD to address concerns about aspen reestablishment in both the short and long term. Where appropriate, aspen may be seeded, planted, or transplanted. Wildland fire, sometimes over large acreages, may be used for regeneration or maintenance of aspen. Management activities that kill or stress overstory trees (e.g., clearcutting, fire) may be used since they mimic natural disturbances and enhance aspen regeneration. Aspen restoration efforts may include providing/improving substitute forage away from aspen, removing conifer competition, fencing to exclude ungulates, and range management practices (e.g., salt locations; herding; timing, intensity, frequency, and duration of livestock use).

Related Plan Content for Forests: Aspen

See the following sections: Overall Ecosystem Health, Soil, All PNVTs, Forests: All Forested PNVTs, Forests: Ponderosa Pine, Forests: Dry Mixed Conifer, Forests: Wet Mixed Conifer, Forests: Spruce-Fir, Wildlife and Rare Plants, Livestock Grazing, and Wildland Fire Management.

Woodlands: All Woodland PNVTs

Background for Woodlands: All Woodland PNVTs

The following objectives, guidelines, and management approaches apply to Madrean pine-oak and piñon-juniper woodland PNVTs in addition to the specific direction listed in those sections. Woodland PNVTs total approximately 617,000 acres.

Desired Conditions for Woodlands: All Woodland PNVTs

See the desired conditions for Madrean pine-oak and piñon-juniper woodland PNVTs.

Objectives for Woodlands: All Woodland PNVTs

- Annually, treat or maintain 5,000 to 15,000 acres to promote a highly diverse structure.

Guidelines for Woodlands: All Woodland PNVTs

- Mechanical restoration of woodlands should emphasize individual tree removal to limit ground disturbance.
- Tree species that are less susceptible to root disease should be retained within areas of root disease infection to reduce spread of disease.
- Treatments should leave single or small groups of medium to large native trees that are widely spaced with expanses of herbaceous vegetation and coarse woody debris to provide for soil productivity, traditional uses (e.g., piñon nut gathering), and wildlife needs such as foraging habitat for migratory birds (e.g., black-throated gray warbler, piñon jay) and other birds.

- Hiding cover, approach cover (by waters), and travel corridor cover should be provided where needed by wildlife.

Management Approaches for Woodlands: All Woodland PNVTs

Treatment methods may include wildland fire, mechanized and hand thinning, leaving woody debris scattered across the ground, soil erosion control, stabilizing gullies to restore water tables, planting grass, and chemical treatments. The majority of treatments are focused in the Madrean pine-oak woodlands (primarily burning) with some treatments occurring in piñon-juniper.

Treated (e.g., cut, burned) alligator juniper and other resprouting species may require follow-up and possibly repeat treatments in order to meet project objectives. Terrestrial ecosystem survey information is useful to identify areas where burning is the most effective management tool.

Related Plan Content for Woodlands: All Woodland PNVTs

See the following sections: All PNVTs, Woodlands: Madrean Pine-Oak, Woodlands: Piñon-Juniper, Wildlife and Rare Plants, Forest Products, and Wildland Fire Management.

Woodlands: Madrean Pine-Oak

Background for Woodlands: Madrean Pine-Oak

Madrean pine-oak woodlands, at roughly 394,900 acres, cover nearly 20 percent of the Apache-Sitgreaves NFs and usually occupy foothills and mountain slopes. Elevations range from approximately 4,000 to 7,000 feet. These woodlands consist of an open to closed canopy of evergreen oaks and various conifers, including gray oak, Emory oak, and alligator juniper. Beneath the canopy, there are annual and perennial grasses, forbs, shrubs, and half-shrubs.

This PNVT's overstory is currently (2011) highly departed from reference conditions. There are too many acres of closed canopy conditions consisting of small, medium, or large trees. Medium to very large trees with herbaceous understory and open canopy are lacking. The herbaceous understory vegetation within the Madrean pine-oak woodland is split, nearly equally, between low to moderately departed and highly to severely departed from desired conditions. The fire regime is also severely departed from reference conditions. Low severity surface fires frequently (every 3 to 8 years) burned through this PNVT maintaining an open stand structure.

Some areas that appear to be Madrean pine-oak woodlands are actually historic semi-desert grasslands that have been encroached by woody species.

Desired Conditions for Woodlands: Madrean Pine-Oak

Landscape Scale Desired Conditions (10,000 acres or greater)

- A mix of desired species[14], ages, heights, and groupings of trees create a mosaic across the landscape.
- The majority of this woodland has an open canopy consisting of large trees and an herbaceous understory, with some groups of closed canopy. Overall, canopy cover is 10 to 50 percent.

- Snags, averaging 1 to 2 per acre, and older trees are scattered across the landscape. Coarse woody debris averages 1 to 5 tons per acre.
- Understory vegetation includes evergreen oaks, mountain mahogany, grasses, and forbs.
- Ground cover consists of perennial grasses and forbs that frequently carry fire through the landscape.
- Grasses, forbs, shrubs, needles, leaves, and small trees support the natural fire regime. The larger proportion (60 percent or greater) of soil cover is composed of grasses and forbs as opposed to needles and leaves.
- Fires are typically of low or occasionally moderate severity (fire regime I) and occur every 5 to 20 years.

Mid-Scale Desired Conditions (100 to 1,000 acres)

- Some large patches in the Madrean pine-oak woodland are closed canopy, have multiple age classes, large trees, and old growth-like characteristics (e.g., numerous snags, large coarse woody debris) in order to provide for wildlife such as Mexican spotted owl and black bear, that need denser habitat.
- The size and number of groups and patches vary depending on disturbance, elevation, soil type, aspect, and site productivity. Patch sizes vary but are mostly tens of acres, with rare disturbances of hundreds of acres. There may be frequent small disturbances resulting in groups and patches of tens of acres or less. A mosaic of groups and patches of trees, primarily even-aged, that are variable in size, species composition, and age, is present. Grass, forb, and shrub openings created by disturbance may compose 10 to 100 percent of the area depending on the disturbances.
- Woodland densities range from 15 to 50 square feet basal area per acre.

Fine Scale Desired Conditions (less than 10 acres)

- Single large trees or small groups are widely spaced between large expanses of herbaceous vegetation and shrubs.

Guidelines for Woodlands: Madrean Pine-Oak

- Where Mexican spotted owls are found nesting in canyons or on north slopes within the Madrean pine-oak woodland, adjacent treatments should be modified to meet the needs of foraging owls.

Related Plan Content for Woodlands: Madrean Pine-Oak

See the following sections: Overall Ecosystem Health, Soil, All PNVTs, Woodlands: All Woodland PNVTs, Wildlife and Rare Plants, Forest Products, and Wildland Fire Management.

Woodlands: Piñon-Juniper

Background for Woodlands: Piñon-Juniper

At roughly 222,200 acres, this woodland PNVT is mostly found on lower slopes of mountains and upland rolling hills at approximately 4,500 to 7,500 feet in elevation. The most common pine is the piñon. The juniper component is a variable mix of one-seed, Utah, alligator, and Rocky Mountain. In addition, annual and perennial grasses, forbs, shrubs, and half-shrubs can be found beneath the more open woodland canopy. Species composition and stand structure vary by location primarily due to precipitation, natural ecological disturbances, elevation, temperature, and soil type.

The piñon-juniper woodland can be divided into two subgroups: savanna and persistent woodland. Savanna, with an herbaceous-dominated understory, generally occurs on flats, basins, gentler east-, south-, and west-facing foothills, gentle uplands, and transitional valleys at generally lower elevations. The soils associated with savanna are moderately deep to deep and biologically productive. The persistent woodland, having a sparse discontinuous understory of some grasses and/or shrubs, generally occurs on flats, ridgetops, rugged uplands, and steep slopes at various elevations, and occurs on soils that are shallow and rocky. Historic records show that where there were larger interspaces between trees and less ground cover, prairie dog colonies were found across the piñon-juniper woodland on the Apache-Sitgreaves NFs.

This PNVT's overstory is currently (2011) slightly departed from reference conditions. When compared to desired conditions, there are too many medium to very large trees with open and/or closed canopies. While there are too few seedlings, saplings, and small trees with open and/or closed canopies, understory vegetation is lacking in many areas. The majority (91 percent) of the herbaceous understory vegetation within the piñon-juniper woodland is highly to severely departed from desired conditions. The current fire regime is similar to reference conditions.

Many areas that appear to be piñon-juniper woodland are actually historic Great Basin grassland that has been encroached by woody species.

Desired Conditions for Woodlands: Piñon-Juniper – Savanna

Landscape Scale Desired Conditions (10,000 acres or greater)

- The piñon-juniper savanna is open in appearance with trees occurring as individuals or in small groups and ranging from young to old. Overall, tree canopy cover is 10 to 15 percent, but may range up to 30 percent.
- Scattered shrubs and a continuous herbaceous understory, including native grasses, forbs, and annuals, are present to support a natural fire regime.
- Grasses, forbs, shrubs, needles, leaves, and small trees support the natural fire regime. The larger proportion (60 percent or greater) of soil cover is composed of grasses and forbs as opposed to needles and leaves.
- Old growth occurs in isolated locations scattered throughout the landscape, as individual old trees or as clumps of old trees. Other old growth components may also be present including dead trees (snags), downed wood (coarse woody debris), and/or structural diversity.

- Fires are low to mixed severity (fire regime I), occurring every 1 to 35 years.

Desired Conditions for Woodlands: Piñon-Juniper – Persistent Woodland

Landscape Scale Desired Conditions (10,000 acres or greater)

- A mix of desired species[14], ages, heights, and groupings of trees create a mosaic across the landscape.
- Tree canopy cover is closed (greater than 30 percent), shrubs are sparse to moderate, and herbaceous cover is patchy.
- Snags, averaging one to two per acre, and older trees with dead limbs and tops are scattered across the landscape. Coarse woody debris averages 2 to 5 tons per acre.
- Old growth includes old trees, dead trees (snags), downed wood (coarse woody debris), and/or structural diversity. The location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality).
- Fire is less frequent and more variable than in the savanna due to patchiness of ground cover. The fires that do occur are mixed to high severity (fire regimes II, III, IV, and V).

Mid-Scale Desired Conditions (100 to 1,000 acres)

- Grass and forb cover is maximized, based on site capability, to protect and enrich soils.

Related Plan Content for Woodlands: Piñon-Juniper

See the following sections: Overall Ecosystem Health, Soil, All PNVTs, Woodlands: All Woodland PNVTs, Wildlife and Rare Plants, Wildland Fire Management, and Community-Forest Intermix Management Area.

Grasslands

Background for Grasslands

There are three grassland PNVTs: semi-desert, Great Basin, and montane/subalpine. Grasslands are characterized by less than 10 percent tree and/or shrub cover. Grassland PNVTs total approximately 344,000 acres.

The semi-desert grassland PNVT encompasses roughly 107,000 acres and occurs below the Mogollon Rim at elevations ranging from approximately 3,200 to 4,500 feet. This grassland is bounded by Chihuahuan Desert at the lowest elevations and Madrean pine-oak woodland or interior chaparral at the higher elevations. Species composition and dominance varies based on soils and topography. Dominant grassland species include black grama, blue grama, hairy grama, tobosa, threeawns, and mixed native perennial forbs. Shrubs also inhabit these grasslands and their abundance and species composition also varies; however, juniper and mesquite are the most common woody species.

The Great Basin grassland PNVT encompasses roughly 185,500 acres and is limited to lower elevations above the Mogollon Rim. It is higher in elevation (approximately 5,500 to 7,500 feet) and climatically cooler and moister than semi-desert grasslands and is adjacent to and intermingles with piñon-juniper savanna ecosystems. Vegetation consists mostly of grasses and forbs with interspersed shrubs. Grass species may include, but are not limited to, Indian ricegrass, threeawns, blue grama, needle and thread, New Mexico feathergrass, green needlegrass, *Muhlenbergia* species, James' galleta, little bluestem, western wheatgrass, and sand dropseed. Shrub and half-shrub species may include, but are not limited to, fourwing saltbush, winterfat, serviceberry, rabbitbrush, fringed sage, and snakeweed. Piñons and junipers are the most commonly encroaching trees.

The montane/subalpine grasslands PNVT, at roughly 51,600 acres, typically occur at elevations ranging from approximately 7,500 to 11,400 feet on gentle to steep slopes. These grasslands contain a mix of species that varies based on moisture. Common species at higher elevations in more moist sites include tufted hairgrass, southwest fescue, Nebraska sedge, yarrow, dryspike sedge, Baltic rush, and nonnative Canada and Kentucky bluegrasses. The more dry upland sites are dominated by mutton bluegrass, Arizona fescue, pine dropseed, mountain muhly, White Mountain sedge, southwest fescue, woolly cinquefoil, and small-leaf pussytoes. Common species at lower elevations in more moist sites include Canada and Kentucky bluegrasses, spike muhly, spreading fleabane, annual *Muhlenbergia* species, white clover, yarrow, and dandelion. The more dry upland sites at lower elevations are dominated by pine dropseed, blue grama, spreading fleabane, prairie junegrass, White Mountain sedge, annual *Muhlenbergia* species, and Fendler's sandwort. Trees may occur along the periphery of these grasslands, primarily ponderosa pine, southwestern white pine, aspen, Engelmann spruce, and subalpine fir, depending on elevation and moisture gradient. Some shrubs may also be present.

Healthy grasslands are important habitat for a variety of wildlife species and are essential to maintain pronghorn antelope populations. Historic records show that prairie dog colonies were commonly found in grassland areas with less ground cover. Grasslands of the Apache-Sitgreaves NFs have undergone dramatic changes over the last 130 years. Changes include encroachment by trees and shrubs, loss of perennial grass cover, loss of cool season species, increase in exposed soil surface, and the spread of nonnative species. Over 75 percent of the semi-desert and 65 percent of the Great Basin grasslands have been encroached by woody species. In addition, the majority (52 percent or greater) of the herbaceous vegetation understories within the semi-desert and Great Basin grasslands are highly departed from desired conditions. However, the majority (68 percent) of the herbaceous understory vegetation within the montane/subalpine grasslands is in moderately departed from desired conditions.

Fire plays a key role in the maintenance of the forests' grasslands. Currently (2011), the three grasslands all show departure from reference conditions in overstory structure and composition, with both semi-desert and Great Basin highly departed, and montane/subalpine moderately departed. Fire historically occurred every 10 to 30 years in the Great Basin and 2 to 10 years in the semi-desert. In the montane/subalpine, fire occurred every 2 to 400 years (depending on the adjacent forested PNVT).

Many areas that appear to be forest or woodland are actually historic grassland that has been encroached by woody species.

Desired Conditions for Grasslands

Landscape Scale Desired Conditions (10,000 acres or greater)

- Perennial herbaceous species dominate and include native grasses, grass-like plants (sedges and rushes), and forbs, and in some locations, a diversity of shrubs.
- Herbaceous vegetation and litter provide for and maintain the natural fire regime (fire regime I and II). In semi-desert grasslands, the natural fire return interval is approximately every 2 to 10 years. In Great Basin grasslands the natural fire return interval is approximately every 10 to 30 years. In montane/subalpine grasslands it ranges from approximately 2 to 400 years, depending on the adjacent forested PNVT.
- Landscapes associated with montane/subalpine grasslands vary from natural appearing where human activities do not stand out (high scenic integrity) to unaltered where only natural ecological changes occur (very high scenic integrity).

Mid-Scale Desired Conditions (100 to 1,000 acres)

- Woody (tree and shrub) canopy cover is less than 10 percent.
- Prairie dogs are present and support healthy grassland soil development and the diversity of associated species (e.g., western burrowing owl).

Fine Scale Desired Conditions (less than 10 acres)

- Average herbaceous vegetation heights[21] vary by grassland PNVT and yearly weather conditions. Ungrazed herbaceous vegetation heights[20]. range from 7 to 29 inches in Great Basin grasslands, 7 to 26 inches in montane/subalpine grasslands, and 10 to 32 inches in semi-desert grasslands.
- During the critical pronghorn antelope fawning period (May through June[22]), cool season grasses and forbs provide nutritional forage; while shrubs and standing grass growth from the previous year provide adequate hiding cover (10 to 18 inches) to protect fawns from predation.

Objectives for Grasslands

- Decrease or maintain the woody canopy cover at less than 10 percent by treating up to 25,000 acres annually.

Guidelines for Grasslands

- Restoration treatment of grasslands should result in a woody canopy cover of less than 10 percent; more than one treatment may be required.

---

[21] Measured on ungrazed plants as an indicator of vigor.

[22] Fawning may extend through mid-July in the high elevation montane/subalpine grasslands.

- Mechanical restoration of grasslands should emphasize individual tree removal to limit soil disturbance.
- New fence construction or reconstruction where pronghorn antelope may be present should have a barbless bottom wire which is 18 inches from the ground to facilitate movement between pastures and other fenced areas. Pole and other types of fences should also provide for pronghorn antelope passage where they are present.
- Pronghorn antelope fence and other crossings should be installed along known movement corridors to prevent habitat fragmentation.

Management Approaches for Grasslands

The management approach is to maintain and improve grasslands by eliminating competing conifers, leaving woody debris scattered across the ground, stabilizing gullies to restore water tables, and reseeding with native species. Treatments are located in restorable and treatable grasslands, primarily in the Great Basin and semi-desert grassland PNVTs. Obliteration and rehabilitation of unauthorized roads and trails may be needed. There is an emphasis to provide enough grass to reduce topsoil loss and allow fire to spread and resume its role in maintaining grasslands. Pronghorn antelope is a management indicator species (MIS) for grassland restoration. The treatment objective listed above would contribute to their viability.

Related Plan Content for Grasslands

See the following sections: Overall Ecosystem Health, Soil, All PNVTs, Wildlife and Rare Plants, Scenic Resources, Livestock Grazing, and Wildland Fire Management.

Interior Chaparral

Background for Interior Chaparral

The interior chaparral PNVT, at roughly 56,000 acres, is typically found on mountain foothills and lower slopes where desert landscapes transition into Madrean pine-oak woodlands. Typically, interior chaparral is structurally uniform and dominated by shrubs with thick, stiff, waxy evergreen leaves. Mixed shrub associations include manzanita, desert ceanothus, mountain mahogany, silktassel, Stansbury cliffrose, yerba de pasmo, evergreen oaks, Arizona cypress, sumacs, and various cacti. Grasses are a minor component in chaparral and may include bullgrass and longtongue muhly.

Current (2011) interior chaparral overstory composition and structure and fire regime are similar to reference conditions. However, approximately 40 percent of the herbaceous understory vegetation within this PNVT is highly departed from desired conditions. Nonnative invasive species, such as mullein, are infesting a portion of the interior chaparral PNVT.

Desired Conditions for Interior Chaparral

- In the early seral state, chaparral contains an herbaceous component in the understory. Later seral states are dense, nearly impenetrable thickets with considerable leaf litter. Standing dead material may accumulate in areas that have not burned for several

decades. Chaparral is in a constant state of transition from early to late seral state and back again, with fire being the major ecological disturbance.

- Ground cover consists primarily (85 to 95 percent) of shrub litter (e.g., small stems, leaves).
- The majority (85 to 95 percent) of chaparral is closed canopy with some interspaces of grasses and forbs.
- High severity fires occur every 35 to 100 years (fire regime IV) in a mosaic pattern.

Management Approaches for Interior Chaparral

Since the interior chaparral is the PNVT closest to reference conditions, the management approach is to maintain that condition into the future, primarily by using wildland fire

Related Plan Content for Interior Chaparral

See the following sections: Overall Ecosystem Health, Soil, All PNVTs, Wildlife and Rare Plants, and Wildland Fire Management.

Wildlife and Rare Plants

Background for Wildlife and Rare Plants

The great variety of habitats found on the Apache-Sitgreaves NFs provide for a wide diversity of plant and animal species. Preliminary estimates account for over 500 wildlife species including 14 native fish, 13 amphibians, 36 reptiles, more than 300 birds, and over 100 mammals. Over 2,000 species of plants have been identified, including nonvascular species like mosses and fungi The forests currently (2014) have 18 species that are listed, proposed, or candidates for listing under the Endangered Species Act of 1973 (Public Law 93-205), 13 with proposed or designated critical habitat. There are more than two dozen plant species designated by the regional forester as sensitive species; these are considered “rare plants” due to the potential for declines in their populations[23].

Figure 6. Golden-crowned kinglet
© Photo courtesy of Nick Saunders

Three areas have been identified by the National Audubon Society for their great diversity of breeding and migratory bird species. These are known as important bird areas (IBAs). The Mogollon Rim Snowmelt Draws IBA is located on the west side of the forests on the Black Mesa Ranger District, extending onto the Coconino National Forest. The Blue and San Francisco Rivers IBA is located on the Alpine and Clifton Ranger Districts. The Upper Little Colorado River IBA on the Springerville Ranger District includes its east, west, and south fork tributaries and extends off the forests to include the AZGFD Wenima Wildlife Area. While these areas provide exceptional birding opportunities, they carry no management obligations or restrictions for the forests.

The modified landscape of the Apache-Sitgreaves NFs does not support the patterns of native species distribution and abundance it once did. Some species are no longer found on the forests (e.g., Merriam elk, grizzly bear) and once common species are now found in limited locations (e.g., California floater, Bebb willow). On the other hand, some species such as Abert’s squirrels may be more abundant today than historically. Unusual or unique native plants growing on the forests include agaves that grow in “colonies” (*Agave parryi*), a species of pine that resprouts (*Pinus leiophylla*), and an aquatic insect-eating plant (*Utricularia macrorhiza*). Other species, some desirable and some not, have been introduced and have become naturalized. In recent years, management changes (e.g., stream buffers for thinning and burning, activity timing restrictions, adjustments in livestock numbers and seasons) have been made to improve habitat. In addition, efforts are underway to restore a number of species including the Chiricahua leopard frog and Mexican wolf.

[23] The status of all sensitive species (both plant and animal) is periodically reviewed by the regional forester. Species can be added or removed from the list based on new information.

The needs of individual or groups of wildlife species include food, water, and shelter. Adequate amount and connectivity of habitat is also crucial to daily and seasonal movements, finding mates, and being able to utilize available habitat across the landscape. Healthy, diverse vegetation and functioning ecosystem processes help ensure diversity of habitats and wildlife, while reducing risks to the sustainability of those habitats and species. In addition, refuges (e.g., wildlife quiet areas, unroaded areas) or unique habitats are necessary to sustain other species.

This section addresses primarily terrestrial species. The “Aquatic Habitat and Species” section addresses fish and other aquatic dependent species. Other sections of the plan address many habitat components and species’ needs. Additional considerations are included here.

Desired Conditions for Wildlife and Rare Plants

Landscape Scale Desired Conditions (10,000 acres or greater)

- Habitat conditions contribute to the recovery of federally listed species.
- Habitat is well distributed and connected.

Mid-Scale Desired Conditions (100 to 1,000 acres)

- Wildlife are free from harassment and disturbance at a scale that impacts vital functions (e.g., breeding, rearing young) that could affect persistence of the species.

Fine Scale Desired Conditions (less than 10 acres)

- Collection of animals and plants does not negatively impact species abundance.
- Localized rare plant and animal communities are intact and functioning.

Objectives for Wildlife and Rare Plants

- Annually, improve wildlife habitat connectivity by removing at least five unneeded structures (e.g., fence).

Guidelines for Wildlife and Rare Plants

- Management and activities should not contribute to a trend toward the Federal listing of a species.
- Activities occurring within federally listed species habitat should apply habitat management objectives and species protection measures from recovery plans.
- Modifications, mitigations, or other measures should be incorporated to reduce negative impacts to plants, animals, and their habitats and to help provide for species needs, consistent with project or activity objectives.

- A minimum of six nest areas (known and replacement) should be located per northern goshawk territory. Northern goshawk nest and replacement nest areas should be located around active nests, in drainages, at the base of slopes, and on northerly (northwest to northeast) aspects. Nest areas should be 25 to 30 acres each in size.
- Northern goshawk post-fledging family areas (PFAs) of approximately 420 acres in size should be designated around the nest sites.
- During treatments, snags should be retained in the largest diameter classes available as needed to meet wildlife or other resource needs.
- Cool and/or dense vegetation cover should be provided for species needing these habitat components (e.g., Goodding's onion, black bear, White Mountains chipmunk, western yellow-billed cuckoo).
- Active raptor nests should be protected from treatments and disturbance during the nesting season to provide for successful reproduction. Specifically for northern goshawk nest areas, human presence should be minimized during nesting season of March 1 through September 30.
- Any action likely to cause a disturbance and take to bald and golden eagles in nesting and young rearing areas should be avoided per the Bald and Golden Eagle Protection Act.
- Prairie dog controls[24] should not be authorized except when consistent with approved State of Arizona Gunnison's prairie dog conservation strategies.
- Rare and unique features (e.g., talus slopes, cliffs, canyon slopes, caves, fens, bogs, sinkholes) should be protected from damage or loss in order to retain their distinctive ecological functions and maintain viability of associated species.
- The needs of localized species (e.g., New Mexico meadow jumping mouse, Bebb willow, White Mountains paintbrush) should be considered and provided for during project activities to ensure their limited or specialized habitats are not lost or degraded.
- Constructed features should be maintained to support the purpose(s) for which they were built. Constructed features should be removed when no longer needed.

Management Approaches for Wildlife and Rare Plants

Conservation of wildlife species remains a high priority on the Apache-Sitgreaves NFs and wildlife considerations are an integral part of planning and activities. The management approach is to provide a diversity of habitats, well distributed, with ecological conditions that support native and desired nonnative animal species over the long term. The forests also provide for wildlife and their needs consistent with recovery plans, biological opinions, conservation strategies, conservation assessments, management plans, memorandums of understanding (MOUs), and Forest Service direction. Species conservation assessments/strategies and agreements executed at the forest level are reviewed every 10 years and updated as necessary. Wildlife and plant species occurring or potentially occurring on the forests are tracked in the

[24] Controls do not include State authorized hunting.

forests' species databases; these are maintained and periodically updated. The forests also support species conservation initiatives such as the Important Bird Area Program.

The forests work collaboratively with the AZGFD to plan and implement projects that make progress toward the forests' desired conditions and help achieve conservation actions specified in the Arizona State Wildlife Action Plan. Large scale wildlife habitat restoration treatments benefit multiple species while small projects address the needs of localized species. The forests also work with AZGFD to develop species and associated habitat management plans (e.g., Gunnison's Prairie Dog Conservation Plan).

The Apache-Sitgreaves NFs work in partnership with the AZGFD to protect and reintroduce native species, including highly interactive species such as beavers, prairie dogs, and wolves, and to control or eradicate nonnative, undesirable species. Agreements are implemented so that appropriate species and subspecies are introduced. The forests coordinate with AZGFD to update national maps showing locally occupied bighorn sheep habitat and domestic sheep grazing allotments. The purpose of this effort, along with site-specific project or activity analyses, is to help prevent disease transmission between domestic and wild sheep. Examples include separation of domestic and wild sheep and development of protocols to prevent straying of domestic sheep from areas they are authorized to graze.

The Apache-Sitgreaves NFs cooperate with other State and Federal agencies and tribes, as well as private entities and adjacent landowners, to support species diversity, recovery, and wildlife management. The forests participate in the development and implementation of conservation plans and activities for identified species to help preclude Federal or State listing. The forests actively participate in implementation of recovery plan actions for federally listed species. Actions (e.g., closures, timing of treatments) are implemented to limit management impacts and disturbances and to help prevent listing of species as threatened or endangered.

Habitat and species monitoring are an integral part of proactive and adaptive wildlife and resource management on the forests. Examples include monitoring of federally listed and candidate species, management indicator species, ecological indicators, land birds, and bears.

The forests coordinate with the AZGFD, Arizona Wildlife Linkages Working Group, and Arizona Department of Transportation (ADOT) to enhance public safety and promote passage of wildlife. There may be a need to develop, construct, and install habitat connecting and safer wildlife crossings and modify proposals to account for important wildlife linkages. An example could be increasing the distance that roadway fences are set back from the road's edge in order to provide herds of animals more room to maneuver during crossings.

The forests coordinate with the Wildlife Service Program of USDA Animal and Plant Health and Inspection Service (APHIS) and the State of Arizona to promote healthy populations of predators, while reducing livestock conflicts with wildlife. Proactive livestock management practices (e.g., separating livestock from predators in time and place, range riders, herding) are incorporated to help keep conflicts from arising. In accordance with the national memorandum of understanding between the Forest Service and APHIS, the effectiveness of wildlife damage management practices is periodically reviewed.

Forest managers recognize the need to acquire a greater understanding of many nongame species (e.g., amphibians, invertebrates, fish), including their habitat requirements and the effects of management activities. The forests encourage and support wildlife research and inventory. The

forests develop partnerships with interested individuals and groups to help implement the wildlife program, including wildlife survey and habitat assessment. The forests also promote public education and valuing of the wildlife resource on the forests. The latter is increasingly important with growing urbanization and forest use.

Where the need is demonstrated, seasonal road restrictions and area closures may be used to provide refuge in small and large blocks of land habitat for a wide range of species.

Related Plan Content for Wildlife and Rare Plants

See the following sections: Overall Ecosystem Health, All PNVTs, Dispersed Recreation, Developed Recreation, Motorized Opportunities, Nonmotorized Opportunities, Livestock Grazing, Minerals and Geology, and Wildlife Quiet Areas.

Invasive Species

Background for Invasive Species

Nonnative plants (including diseases) and animals (including insects) that do, or have the potential to do, ecological or economic harm are classified as invasive species. Invasive species can be terrestrial or aquatic. On the Apache-Sitgreaves NFs, numerous invasive species pose risks to native species and ecosystem function and to the production of forest goods and services. Invasive plants, of which there are over 50 species, are currently (2008) found on at least 30,000 acres of the forests. For example, musk thistle and Siberian elm have spread along roadways, bull thistle has established in numerous meadows and wetlands, and tamarisk has become common along many streams and lakes. Crayfish, also common in many streams and lakes, are harming several native aquatic species.

Figure 7. Yellow toadflax, an invasive species on the Apache-Sitgreaves NFs
© Photo courtesy of Michael Shepherd, USDA Forest Service, Bugwood.org

Management of invasive species is an increasing need across all PNVTs on the Apache-Sitgreaves NFs. There is an array of tools (chemical, biological, mechanical, and cultural) to help managers control or eradicate these species. To address terrestrial invasive plants, managers have implemented an integrated forestwide noxious or invasive weed management program. Even though complete eradication of invasive species is not always possible, aggressive treatment of existing populations, along with prevention of new infestations or populations, is important to protect native ecosystem diversity.

Desired Conditions for Invasive Species

Landscape Scale Desired Condition (10,000 acres or greater)

- Invasive species (both plant and animal) are nonexistent or in low occurrence to avoid negative impacts to ecosystems.

Mid-Scale Desired Conditions (100 to 1,000 acres)

- Undesirable nonnative species are absent or present only to the extent that they do not adversely affect ecosystem composition, structure, or function, including native species populations or the natural fire regime.
- Introduction of additional invasive species rarely occurs and is detected at an early stage.

Objectives for Invasive Species

- Annually, contain, control, or eradicate invasive species (e.g., musk thistle, Dalmatian toadflax) on 500 to 3,500 acres.
- Annually, control or eradicate invasive species (e.g., tamarisk, bullfrogs) on at least 2 stream miles.

Standards for Invasive Species

- Projects and authorized activities shall be designed to reduce the potential for introduction of new species or spread of existing invasive or undesirable aquatic or terrestrial nonnative populations.

Guidelines for Invasive Species

- Projects and activities should not transfer water between drainages or between unconnected water bodies within the same drainage to avoid spreading disease and aquatic invasive species.
- Project areas should be monitored to ensure there is no introduction or spread of invasive species.
- Treatment of invasive species should be designed to effectively control or eliminate them; multiple treatments may be needed.
- Pesticide use should minimize impacts on nontarget plants and animals.

Management Approaches for Invasive Species

The forests use an integrated management approach with the goal of preventing, controlling, or eradicating invasive species. This involves prioritizing both species and areas for treatment, depending on risk, and identifying the most appropriate methods for control and eradication. Particular attention is needed for treatment of yellow starthistle, tamarisk, musk thistle, and bull

thistle. Species not yet extensive which provide good opportunity for treatment success include Dalmatian toadflax, Canada thistle, and bullfrogs. Treatment efforts are focused in roadways, developed recreation sites, trailheads, boating areas, and areas with mechanical treatments or concentrated use (e.g., corrals, driveways, log landings, dispersed campsites, pile burn sites). The control or eradication of crayfish and undesirable nonnative fish is needed to restore native aquatic species; however, more research is needed to determine effective tools for aquatic invasive species.

Forest employees identify, locate, and report invasive species occurrences. The forests maintain an inventory which identifies areas of invasive species occurrence. Because of the often aggressive and tenacious nature of invasive species, the forests apply timely initial treatments with follow-up treatments for as long as needed to meet either eradication or control goals.

The forests continue to provide education and outreach programs designed to increase employee, public, and permittee awareness. Implementation of preventative measures (e.g., pre- and post-work equipment sanitation, requiring certified weed-free seed and hay) continues through permitting, contracting, and other forest administrative processes. The forests continue to utilize vehicle wash stations to prevent spread of noxious weeds, nonnative invasive plants, insects, and disease pathogens.

Where determined appropriate, the forests collaborate with other agencies and entities in efforts to replace nonnative aquatic species with natives. The forests encourage ADOT to treat noxious weeds and undesirable nonnative invasive plants along highways. The forests cooperate with the Natural Resource Conservation Service (NRCS), APHIS, AZGFD, ADOT, Arizona Department of Agriculture (ADA), tribes, State and county extension services, local governments, and other organizations (e.g., Little Colorado River Weed Management Group) to support a successful invasive species management program. The Apache-Sitgreaves National Forests coordinate with and support the AZGFD in the use of aquatic habitat and species improvement methods in order to move aquatic resources toward desired conditions when such methods are consistent with applicable plan components.

Related Plan Content for Invasive Species

See the following sections: Overall Ecosystem Health, Aquatic Habitat and Species, All PNVTs, Wildlife and Rare Plants, Conservation Education, and Special Uses.

Landscape Scale Disturbance Events

Background for Landscape Scale Disturbance Events

Landscape scale (generally over 10,000 acres) disturbance events are recurring natural ecological processes with characteristic outcomes. However, given current (2011) departure from reference conditions, outcomes can be uncharacteristic where there are drastic changes in soil and vegetation components. These can lead to ecological succession away from desired conditions, which can be complicated by other factors like climate change and invasive species. When uncharacteristic outcomes occur, the landscape can take hundreds of years or more to recover to some level of stability. Where outcomes are uncharacteristic and there are needs to accelerate recovery, additional direction is provided to protect existing resources and facilitate recovery of soil and vegetation components and improve ecosystem health.

Desired Conditions for Landscape Scale Disturbance Events

Landscape Scale Desired Conditions (10,000 acres or greater)

- The Apache-Sitgreaves NFs landscapes retain the resiliency to survive landscape scale disturbance events.

Standards for Landscape Scale Disturbance Events

- Threats to human safety and property shall be promptly addressed following landscape scale disturbance and mitigated through measures such as signing, temporary closures, or treatment.

Guidelines for Landscape Scale Disturbance Events

- Erosion control mitigation features should be implemented to protect significant resource values and infrastructure such as stream channels, roads, structures, threatened and endangered species, and cultural resources.
- Felling of hazard trees (either dead or alive) should be limited to those which could hit a road, recreation site, building, or other infrastructure to protect places where humans, vehicles, or developments would most likely be present.
- Projects and activities (e.g., revegetation, mulching, lop and scatter) should be designed to stabilize soils and restore nutrient cycling, if needed, and establish movement toward the desired conditions for the affected PNVT(s).
- Where conifer seed sources are lost or poorly distributed and/or deciduous tree species are not adequately resprouting, artificial regeneration (e.g., planting, seeding) should be used to promote movement toward desired conditions, provided adequate site conditions exist.
- Management should emphasize long term reestablishment of native deciduous trees, shrubs, and herbaceous vegetation to maintain ecosystem diversity.
- An adequate number and size of snags and logs, appropriate for the affected PNVT, should be retained individually and in clumps to provide benefits for wildlife and coarse woody debris for soil and other resource benefits.
- Projects and activities should include both short and long term provisions for scenic integrity, especially in sensitive foreground areas (high and very high scenic integrity).

Management Approaches for Landscape Scale Disturbance Events

Managers consider the large scale event recovery guidance in Forest Service Manual 2030 when responding to these disturbance events. Hazard trees may be removed along roads to meet guidance in FSM 2330 (publicly managed recreation opportunities) and FSM 7700 (travel management). Where extensive tree mortality results from landscape scale disturbance and economic value exists, salvage of dead trees may be considered where this contributes to the movement toward desired conditions. Deferral of ecological restoration or salvage projects and activities may also be considered where these are not necessary for recovery.

Principles for ecological restoration and resilience as outlined in FSM 2020 are the basis for ecological restoration projects and activities. Based on site conditions, ecological restoration projects and activities focus on establishing and ensuring survival of native vegetation. Non-persistent cereal grain seeding can be used after high severity wildfires to provide additional soil cover, alone or in conjunction with application of weed-free mulch, as long as treatments are consistent with EO 13112, FSM 2900, FSM 2523.2, and FSM 5100, Chapters 40 and 50.

Native tree and shrub planting follows plan guidelines for those individual forested and woodland PNVTs. To ensure their persistence, there is a focus on reintroduction of fire, protection of tree regeneration, treatment of insects and disease, or adjustment of management actions as needed. Additional direction found in the FSM 2400, Chapters 70 and 90, and FSM 2300, Chapter 20, guides managers in silvicultural practices, reforestation, and forest management in wilderness. Where wild ungulate use is hindering long term reestablishment of deciduous tree species, managers work with the AZGFD to address the situation.

Developed sites (recreation and administration) are evaluated following a landscape disturbance event for short and long term viability for continued use or for modification of the site. Site action plans are developed for implementation. Roads in event areas are evaluated for current and future access needs. Opportunities to decommission roads that are identified as no longer necessary for forest management and access or to relocate necessary access routes are considered. Forest boundary and/or other ownership landlines and land survey monuments are re-established and posted where needed.

Related Plan Content for Landscape Scale Disturbance Events

See the following sections: Overall Ecosystem Health, Soil, Water Resources, All PNVTs, Developed Recreation, Motorized Opportunities, Scenic Resources, and Wildland Fire Management.

Managed Recreation

Overall Recreation Opportunities

Background for Overall Recreation Opportunities

The primary recreation activities are “relaxing and escaping the heat,” fishing, hiking, off-highway-vehicle (OHV) use, viewing natural features and wildlife, camping, driving for pleasure, picnicking, and large group gatherings. A wide variety of other activities, including boating and hunting, also occur on the forests. There are over 30 lakes and reservoirs and more than 1,000 miles of rivers and streams, more than can be found in any other national forest in the Southwestern Region. The forests are a destination for winter activities including snow play, snowmobiling, ice fishing, cross-country skiing, and sledding.

The Apache-Sitgreaves NFs receive approximately 2 million visitors per year. A high proportion of these visitors spend the night on the forests. Approximately 70 percent of the forests’ Arizona visitors are from the Phoenix and Tucson metropolitan areas. These visitors, including those that view wildlife, hunt, and fish, contribute significantly to the economic well-being of the surrounding areas. The forests’ contribution to the local economy from the recreation and wildlife areas is approximately 69 percent of the local jobs and 68 percent of the local labor income (Forest Service, 2009a).

Highway improvements provide easier access to the forests from Arizona's major metropolitan areas, increasing the number of visitors and demand for recreation. The demographics of the recreating public are changing. An aging and urban population and increased ethnic diversity contribute to an increased demand for an array of recreation opportunities.

Forest managers face major challenges in providing quality recreation opportunities, maintaining a safe transportation system, and providing for resource protection.

Desired Conditions for Overall Recreation Opportunities

- The Apache-Sitgreaves NFs offer a spectrum of recreation settings and opportunities varying from primitive to rural and dispersed to developed, with an emphasis on the natural appearing character of the forests.
- Inventoried roadless areas (IRAs) maintain their overall roadless character.
- Recreation activities occur within the ability of the land to support them and with minimal user conflicts.
- Recreation enhances the quality of life for local residents (e.g., social interaction, physical activity, connection with nature), provides tourist destinations, and contributes monetarily to local economies.
- Recreation opportunities provide for a variety of skill levels, needs, and desires in partnership with recreation permit holders, private entities, volunteer groups, community groups, and State, Federal, and tribal governments.
- Visitors can easily access information about recreation activities and safe and proper use of the Apache-Sitgreaves NFs.
- Recreation use does not negatively affect wildlife habitat and populations. Negative interactions between people and wildlife are minimized.
- The Apache-Sitgreaves NFs are free from vandalism and refuse.
- Recreation use does not negatively affect the use and character of cultural resources.
- "Leave No Trace" principles are practiced.

Guidelines for Overall Recreation Opportunities

- Recreation related project level decisions and implementation activities should be consistent with mapped classes and setting descriptions in the recreation opportunity spectrum (ROS).
- Developed and dispersed recreation sites and other authorized activities should not be located in places that prevent wildlife or livestock access to available water.
- Food and other items that attract wildlife should be managed to prevent reliance on humans and to reduce human-wildlife conflicts.
- Constructed features should be maintained to support the purpose(s) for which they were built. Constructed features should be removed when no longer needed.

Management Approaches for Overall Recreation Opportunities

The primary management approach is to continue the availability of outdoor opportunities visitors seek and which are not readily available from other public or private entities. These opportunities must be compatible with the environment and other uses.

To better understand future recreation needs, supply and demand studies (capacity analyses) may be completed for high use recreational areas and outfitter and guide permits. There is a focus on reducing conflicts between users and resources, utilizing tools such as law enforcement, public involvement, and education. Private ventures and partnerships may be used to help provide recreation opportunities to forest visitors.

The recreation opportunity spectrum (ROS) map establishes desired ROS classes for the management areas of the Apache-Sitgreaves NFs. The ROS classes reflect desired settings that provide information for project and activity level decisions and implementation activity. The ROS classes define broad physical, social, and administrative settings. Site-specific analysis is necessary to further refine desired settings that may apply at the project or activity level. The ROS map can be found in the plan set of documents.

Related Plan Content for Overall Recreation Opportunities

See the following sections: Soil, Riparian Areas, Water Resources, Wildlife and Rare Plants, Dispersed Recreation, Developed Recreation, Motorized Opportunities, Nonmotorized Opportunities, Scenic Byways, National Recreation Trails, Eligible and Suitable Wild and Scenic Rivers, Scenic Resources, Conservation Education, Cultural Resources, Special Uses, Wilderness, Primitive Area, and Recommended Wilderness.

Dispersed Recreation

Background for Dispersed Recreation

Visitors to the Apache-Sitgreaves NFs participate in a variety of dispersed recreation activities. These activities range from motorized to nonmotorized and consumptive to nonconsumptive. Some examples of dispersed recreation are hunting and fishing, camping, trail use, sightseeing, driving for pleasure, snowmobiling, cross-country skiing, wildlife viewing, and picnicking. The forests are known for their backcountry opportunities: three designated wilderness areas, the Blue Range Primitive Area, and roadless areas encompassing over 300,000 acres.

In spite of the large expanse of undeveloped area available for dispersed recreation use (both motorized and nonmotorized), every acre is not suitable for every use. The challenge for forest visitors and managers is to protect multiple use opportunities and to minimize conflicting uses while, at the same time, maintaining freedom of choice to the greatest extent possible.

Desired Conditions for Dispersed Recreation

- Dispersed recreation opportunities (e.g., hunting, fishing, hiking, camping) are available and dispersed recreation sites (e.g., campsites, trailheads, vistas, parking areas) occur in a variety of ROS classes throughout the forests.

- Facilities for dispersed recreation activities are appropriate for the ROS class and scenic integrity objective of the location and are designed to the minimum necessary to protect natural and cultural resources.
- Wildlife viewing areas are dispersed throughout the forests and provide opportunities to view waterfowl, migratory birds, elk, and other species.
- Access, parking, regulations, orientation, and safety information are in place to provide safe and enjoyable dispersed recreation opportunities.
- Water-based settings are available and the associated recreation opportunities (e.g., canoeing, fishing, waterfowl hunting) do not degrade aquatic resources.
- Winter nonmotorized areas provide a variety of nonmotorized recreation opportunities in a quiet, natural setting (including groomed and ungroomed ski trails). Noise from motorized use is uncommon in areas away from main road corridors.
- Winter motorized areas provide a variety of motorized recreation opportunities with a variety of challenges including areas open to cross-country, over-snow motorized use, some with groomed or ungroomed trails.
- Roads and trails provide a variety of opportunities to view natural landscapes and wildlife.

Objectives for Dispersed Recreation

- Annually, rehabilitate, stabilize, revegetate, or relocate an average of five dispersed campsites to improve recreation opportunities and/or protect the environment.
- Within the planning period, work with the AZGFD, ADOT, and other partners to provide at least 10 new wildlife viewing opportunities.

Standards for Dispersed Recreation

- Dispersed campsites shall not be designated in areas with sensitive soils or within 50 feet of streams, wetlands, or riparian areas to prevent vegetation and bank damage, soil compaction, additional sediment, or soil and water contamination.

Guidelines for Dispersed Recreation

- In dispersed areas, the priority for facilities or minor developments should be access and protection of the environment, rather than the comfort or convenience of the visitors.
- Timing restrictions on recreation uses should be considered to reduce conflicts with wildlife needs or soil moisture conditions.
- Dispersed campsites should not be located on or adjacent to archaeological sites or sensitive wildlife areas.

Management Approaches for Dispersed Recreation

Forest managers recognize the importance and popularity of dispersed recreation and seek to balance the strong desire people have for freedom of choice (in terms of their recreation activity) with adequate protection of cultural and natural resources. Focus is on providing quality dispersed recreation opportunities and reducing conflict among recreation users. Where intensive dispersed use—including camping—occurs (e.g., Bear Canyon Lake, south of Big Lake), managers consider the development of a management plan to delineate the intensive use area, address resource concerns, and provide for sustainable recreation.

Related Plan Content for Dispersed Recreation

See the following sections: Soil, Riparian Areas, Water Resources, Wildlife and Rare Plants, Overall Recreation Opportunities, Conservation Education, and Cultural Resources.

Developed Recreation

Background for Developed Recreation

There are over 50 developed campgrounds, offering single family, multifamily, and large group campsites. Other developed recreation opportunities include picnic areas, boating and fishing sites, trailheads, two visitor centers, and scenic overlooks.

In the late 1980s, the Apache-Sitgreaves NFs first awarded concessionaire permits to a private corporation to manage and operate the majority of the developed recreation sites; more than half of the developed campgrounds are currently (2014) operated by concessionaire. One developed recreation area, Fools Hollow Lake, is operated through a partnership with Arizona State Parks, Arizona Game and Fish Department, and the City of Show Low. The Apache-Sitgreaves NFs have one rental cabin located on the Alpine Ranger District.

Desired Conditions for Developed Recreation

- Developed recreation sites provide opportunities for people to camp, obtain information, and participate in day-use activities (e.g., picnic areas, fishing piers, scenic overlooks, wildlife viewing sites).
- Facilities are maintained, accessible, and complement the forests' natural character. Facilities range from primitive to highly developed, with an emphasis on blending the facilities with the landscape.
- Forest vegetation in developed sites is healthy (species, size, and age) and complements recreational activities, scenery, and human safety.
- Developed campgrounds are places where structures and human caused vegetation changes may be seen but they do not dominate the view or attract attention (low to moderate scenic integrity). Human activities in the areas visible from campgrounds (foreground to middle ground, 300 feet to 4 miles) should not attract attention or stand out, and the landscapes should appear natural (moderate to high scenic integrity).
- Developed campgrounds provide roaded natural or roaded modified recreation opportunities.

Objectives for Developed Recreation

- Within the planning period, reduce the developed recreation deferred maintenance backlog at plan approval by 10 percent.
- Within the planning period, accessible and wildlife-resistant trash facilities should be provided in all developed sites where trash is collected.

Standards for Developed Recreation

- Where trash facilities are provided, they shall be bear resistant.

Guidelines for Developed Recreation

- Developed recreation sites should not be constructed unless validated with a capacity analysis.

Management Approaches for Developed Recreation

Focus is on maintaining the forest recreation and administrative developments in a safe and sustainable manner while providing for quality opportunities for visitors. As the Apache-Sitgreaves NFs move into the future, the emphasis is to balance new construction with current and future maintenance requirements.

Forest managers assess Apache-Sitgreaves NFs recreation and administrative facilities in order to establish a program that is sustainable, realistic, and responsive to public need. Facilities may be redesigned, as necessary, in order to accommodate persons with disabilities, respond to demographic changes, and reduce conflicts with cultural and natural resources as outlined in the recreation facility analysis and master plan. Recreation site plans describe the detailed management for each developed recreation area, including vegetation management plans for campgrounds. Future recreational rental designations (e.g., cabins) are considered on a case-by-case basis including administrative and public benefits.

Figure 8. Woods Canyon Lake

Related Plan Content for Developed Recreation

See the following sections: Overall Recreation Opportunities, Wildlife and Rare Plants, and Conservation Education.

Motorized Opportunities

Background for Motorized Opportunities

Over 2,900 miles of roads and trails are open for public motorized use. These roads and trails are also needed for forest management or administrative use. Summers, holidays, and hunting seasons generally have high volumes of motor vehicle traffic. OHV use continues to increase. Unauthorized (user-created) routes and motorized use on closed roads are major concerns.

Desired Conditions for Motorized Opportunities

- A maintained road and motorized trail system is in place and provides for safety and access for the use (e.g., recreation, minerals, vegetation treatment, fire protection) of the Apache-Sitgreaves NFs.
- Users have opportunities for motorized access and travel on a system of designated NFS roads, NFS motorized trails, and motorized areas[25].
- The transportation system provides a variety of recreation opportunities including varying degrees of difficulty, from OHV trails to paved scenic byways, while limiting resource and/or user conflicts.
- NFS roads, motorized trails, and motorized areas are easily identified on the ground (e.g., well marked).
- The road and trail system is accessible from local communities, State, county, and local public roads and trails.
- Loop trails exist for motorized trail users.
- Tread Lightly!® principles are commonly practiced.
- The location and design of roads and trails does not impede wildlife and fish movement.

Objectives for Motorized Opportunities

- Annually, maintain at least 20 percent of the passenger vehicle and 10 percent of the high-clearance vehicle NFS roads.
- Annually, maintain at least 20 percent of NFS motorized trails.

Standards for Motorized Opportunities

- Motorized vehicle travel shall be managed to occur only on the designated system of NFS roads and motorized trails and designated motorized areas.
- Unless specifically authorized, motorized cross-country travel shall be managed to occur only in designated motorized areas.

[25] The Apache-Sitgreaves NFs will designate NFS roads, NFS motorized trails, and motorized areas through a separate travel management analysis.

- Temporary road construction shall minimize the impacts to resource values and facilitate road rehabilitation. Temporary roads shall be rehabilitated following completion of the activities for which they were constructed.
- Road maintenance and construction activities shall be designed to reduce sediment (e.g., water bars, sediment traps, grade dips) while first providing for user safety.

Guidelines for Motorized Opportunities

- New motorized trails or additions to designated trails should include destinations and loops to provide for a variety of opportunities.
- New roads or motorized trails should be located to avoid Mexican spotted owl protected activity centers, northern goshawk post-fledging family areas, and other wildlife areas as identified; seasonal restrictions may be an option.
- New roads, motorized trails, or designated motorized areas should be located to avoid meadows, wetlands, seeps, springs, riparian areas, stream bottoms, sacred sites, and areas with high concentrations of significant archaeological sites. The number of stream crossings should be minimized or mitigated to reduce impacts to aquatic species.
- As projects occur in riparian or wet meadow areas, unneeded roads or motorized trails should be closed or relocated, drainage restored, and native vegetation reestablished to move these areas toward their desired condition.
- As projects occur, roads or motorized trails that contribute to negative impacts on cultural resources should be closed or relocated.
- As projects occur, redundant roads or motorized trails should be removed to reduce degradation of natural resources.
- Roads and motorized trails removed from the transportation network should be treated in order to avoid future risk to hydrologic function and aquatic habitat.
- Trail markings (e.g., signs) should be designed to complement the character of the surrounding lands.
- Roads and motorized trails should be designed and located so as to not impede terrestrial and aquatic species movement and connectivity.
- As projects occur, existing meadow crossings should be relocated or redesigned, as needed, to maintain or restore hydrologic function using appropriate tools such as French drains and elevated culverts.
- After management activities occur in areas with high potential for cross-country motorized vehicle use, methods (e.g., barriers, signing) should be used to control unauthorized motorized use.

Management Approaches for Motorized Opportunities

Access and opportunities to experience areas through motorized travel are key components of recreation, as well as a management emphasis for the Apache-Sitgreaves NFs. The Apache-

Sitgreaves NFs provide a serviceable and sustainable transportation system that meets the need for public access, land management, resource protection, and user safety. The management approach is to enhance opportunities for motorized trail users, relocate trails to reduce conflicts between motorized and nonmotorized users or other resources, and develop management plans for designated motorized use areas.

This plan provides the framework to guide future changes to the transportation system. Once the final decision of this plan has been made, potential changes to the forests' transportation system will be evaluated under this framework and through implementation of the Travel Management Rule (36 CFR § 212) as required by Executive Order 11644. Upon completion of travel management planning, the associated motor vehicle use map (MVUM) would be printed. The MVUM would display the roads, trails, and areas that are designated for motorized vehicle use. Travel management planning is not a static process. Based on public input, monitoring, and site-specific analysis, the MVUM could be adjusted. The annual reissuing of the MVUM would reflect any changes made through the NEPA process. Use inconsistent with those designations, and inconsistent with this plan, would be prohibited.

Approval of temporary road construction is contingent on the completion of an environmental analysis that addresses road construction and road obliteration, including setting timelines.

When routes are removed from the transportation system, follow-up treatments may include outsloping roadbeds, removing stream crossing structures, breaching drainage ditches, removing unstable fills, maintaining or restoring fish passage, and removing invasive weeds.

Measures (e.g., education, signage, law enforcement, seasonal road closures) are used to discourage encroachment of motorized vehicles into nonmotorized areas and to protect wildlife, infrastructure, and other resources. Emphasis is placed on reducing user conflict and resource damage. Resource damage from vehicle use is rehabilitated as soon as possible. The forests promote roadside interpretive services along scenic byways. Educational techniques (e.g., brochures, signs) may be used to help visitors understand proper motorized use etiquette.

The Apache-Sitgreaves NFs coordinate with the Federal Highway Administration and ADOT to facilitate transportation needs, planned improvements, and transportation conditions. Apache-Sitgreaves NFs work with ADOT to alleviate concerns with scenic resources; maintenance activities; use of herbicides; use of deicing agents; and creation of safety turnouts, parking lots, and wildlife crossings.

Trail maintenance priorities are based on providing user safety, minimizing erosion, providing appropriate recreation opportunities, and accommodating administrative needs. The forests work with partners and volunteers to maintain trails, including the Adopt-A-Trail Program and user groups. Partnerships are in place prior to new motorized trail construction to facilitate trail maintenance.

Related Plan Content for Motorized Opportunities

See the following sections: Soil, Riparian Areas, Water Resources, All PNVTs, Wildlife and Rare Plants, Overall Recreation Opportunities, Scenic Byways, and Cultural Resources.

Nonmotorized Opportunities

Background for Nonmotorized Opportunities

The Apache-Sitgreaves NFs have approximately 1,000 miles of nonmotorized trails for hiking, horseback riding, mountain biking, and cross-country skiing. Trail conditions are variable across the forests, with maintenance focused on high use trails. Several trails are paved to provide additional opportunities for visitors with physical limitations. National recreation trails are addressed following the “Scenic Byways” section.

Desired Conditions for Nonmotorized Opportunities

- Nonmotorized opportunities are available in a variety of settings that provide differing levels of challenge and seclusion.
- Blocks of forest land accessible from populated areas are available for nonmotorized opportunities. These areas are free from the sights and sounds of motorized recreation.
- Opportunities for primitive recreation are available.
- A maintained and environmentally sound nonmotorized trail network is in place, providing for user safety and access to locations of interest for a variety of uses.
- Nonmotorized trails are defined and marked.
- Destination and loop trails exist for nonmotorized users.

Objectives for Nonmotorized Opportunities

- Annually, maintain at least 20 percent of nonmotorized trails.

Guidelines for Nonmotorized Opportunities

- Trail markings (e.g., signs, blazes) should be designed to complement the character of the surrounding lands.
- New nonmotorized routes should avoid meadows, wetlands, seeps, springs, riparian areas, stream bottoms, sacred sites, and areas with high concentrations of significant archaeological sites. The number of stream crossings should be minimized or mitigated to reduce impacts to aquatic habitat.
- To maintain nonmotorized user opportunities, nonmotorized trails should not be colocated on open motorized routes.
- New trails and trail relocations should be designed and located so as to not impede terrestrial and aquatic species movement and connectivity.
- Meadow crossings should be designed or redesigned to maintain or restore hydrologic function using appropriate tools such as French drains and elevated culverts.

Management Approaches for Nonmotorized Opportunities

Access and opportunities to experience areas through nonmotorized travel are key components of recreation. The Apache-Sitgreaves NFs provide a serviceable and sustainable trail system that meets the need for public access, land management, resource protection, and user safety. Emphasis is on reconstructing or adding nonmotorized trails near population centers or developed recreation sites to provide additional or enhanced nonmotorized recreational opportunities.

Signing, enforcement, public information, seasonal and special closures, maintenance, construction, and restoration take place as appropriate. Emphasis is placed on reducing user conflict and resource damage. Educational techniques (e.g., brochures, signs) enhance visitor knowledge of proper nonmotorized use etiquette.

Trail maintenance priorities are based on providing user safety, minimizing erosion, providing appropriate recreation opportunities, and accommodating administrative needs. Partnerships are in place prior to new nonmotorized trail construction to facilitate trail maintenance. The forests work with partners, user groups, and volunteers to maintain trails, including the Adopt-A-Trail Program.

Related Plan Content for Nonmotorized Opportunities

See the following sections: Overall Recreation Opportunities, National Recreation Trails, Wildlife and Rare Plants, Riparian Areas, Soil, Scenic Resources, and Water Resources.

Scenic Byways

Background for Scenic Byways

Three scenic byways pass through the Apache-Sitgreaves NFs: Coronado Trail National Scenic Byway, From the Desert to Tall Pines Scenic Road, and White Mountain Scenic Road. Scenic byways are considered special areas by the Forest Service.

In September 2005, the 120-mile Coronado Trail National Scenic Byway was designated by the Federal Highway Administration. This route has also been a national forest byway and Arizona State scenic byway since 1989. This byway traverses the Springerville, Alpine, and Clifton Ranger Districts.

The From the Desert to Tall Pines Scenic Road has been a national forest scenic road and Arizona State scenic byway since 1996. Approximately 3 miles of this 67 mile scenic road are on the Black Mesa Ranger District. The 123-mile White Mountain Scenic Road has been an Arizona State scenic byway since 1992 and a national forest byway since 1989. This byway is partially located on the Springerville Ranger District.

Desired Conditions for Scenic Byways

- Viewsheds along scenic byways provide natural appearing landscapes and enhance recreation tourism that supports local communities.
- The intrinsic qualities identified for each scenic byway remain intact.
- Scenic byways exhibit natural appearing landscapes where human activities do not stand out in the foreground, up to one-half mile (high scenic integrity).

- Scenic byways provide roaded natural recreation opportunities.

Guidelines for Scenic Byways

- Visual impacts from vegetation treatments, recreation uses, range developments, and other structures should blend with the overall landscape character along scenic byways.
- Signs, kiosks, and other exhibits should provide interpretive, education, and safety information along scenic byways and in adjacent recreation sites.

Management Approaches for Scenic Byways

Forest managers work with partners to implement the "Coronado Trail Corridor Management Plan."

Related Plan Content for Scenic Byways

See the following sections: Motorized Opportunities and Scenic Resources.

National Recreation Trails

Background for National Recreation Trails

The forests have four national recreation trails (NRTs), all designated in 1979: Blue Ridge, General George Crook, Eagle, and Escudilla. NRTs provide a variety of outdoor recreation opportunities and are accessible from urban areas. NRTs are considered a special area by the Forest Service.

The Blue Ridge NRT, located on the Lakeside Ranger District, is approximately 9 miles long. The trail climbs the west side of Blue Ridge Mountain (7,650 feet in elevation) through a mixture of pines, junipers, and many varieties of wildflowers. The mountain itself is a volcanic remnant. There are scenic views from the summit.

Fifty-eight miles of the 114-mile long General George Crook NRT are located in both the Black Mesa and Lakeside Ranger Districts. The trail is part of the route used by General George Crook to deliver supplies to outposts including Fort McDowell, Fort Verde, Camp Reno, Fort Apache, and Camp San Carlos. This route became one of the first major roads in Arizona and was used for decades as a supply and communications route. The original blazes can still be seen on the ponderosa pines lining the trail, as well as occasional traces of homesteads. The trail is popular with equestrians, mountain bikers, and hikers.

The Eagle NRT, located on the Clifton Ranger District, is approximately 28 miles long. The northern end of the trail begins on the Mogollon Rim at about 9,000 feet elevation and descends over 4,000 feet through a variety of vegetation types (mixed conifer to riparian) to its southern trailhead adjacent to Eagle Creek Road. The trail traverses several canyons, each with its own unique scenery and vegetation.

Escudilla NRT, located on the Alpine Ranger District, is approximately 3 miles long. The trail ascends Arizona's third highest mountain and is located in Escudilla Wilderness. Administrative

designation of the trail predates wilderness designation. Forest Service policy discourages national recreation trails in designated wilderness.

Desired Conditions for National Recreation Trails

- The Blue Ridge NRT provides a nonmotorized trail opportunity where visitors can experience the scenic qualities of the area.
- The General George Crook and Eagle NRTs provide nonmotorized trail opportunities where visitors can experience the historic and scenic qualities of the area.
- The immediate foreground (0 to 200 feet) views from the NRTs vary from natural appearing landscapes where human activities do not stand out (high scenic integrity) to unaltered landscapes where generally only ecological changes occur (very high scenic integrity).

Objectives for National Recreation Trails

- Within 5 years of plan approval, initiate the process for the regional forester to remove the NRT designation from the Escudilla trail in conformance with Forest Service Manual 2353.57 – Management of National Recreation Trails.

Standards for National Recreation Trails

- Visual impacts from vegetation treatments, wildland fire, recreation uses, range developments, and other structures will blend with the overall landscape character along national recreation trails.

Guidelines for National Recreation Trails

- Trail markings (e.g., signs, blazes) should be designed to complement the character of the surrounding lands.
- National recreation trails should be managed for nonmotorized or mechanized travel where permitted; however, the General George Crook and Eagle NRTs may have motorized travel where the trail coincides with a designated road or motorized trail.
- New developments which do not support use of, or enhance, a national recreation trail should not be placed within the visual corridor of the trail.
- The General George Crook National Recreation Trail should be managed to preserve evidence of historic roadway and landscape character, including related historic trees, markers, gravesites, and water holes within a 200-foot corridor.

Related Plan Content for National Recreation Trails

See the following sections: Nonmotorized Opportunities and Cultural Resources.

Eligible and Suitable Wild and Scenic Rivers

Background for Eligible and Suitable Wild and Scenic Rivers

There are no designated wild and scenic rivers[26] on the Apache-Sitgreaves National Forests. However, the forests have over 20 eligible rivers and 2 suitable rivers, which reflects the importance of water and its presence on the Apache-Sitgreaves NFs. Eligible and suitable wild and scenic rivers are considered special areas by the Forest Service.

There are approximately 339 miles of 23 rivers that are eligible to be included in the National Wild and Scenic Rivers System (table 1). There are 172 miles classified as wild, 66 miles classified as scenic, and 101 miles classified as recreational. These rivers are located in all ranger districts except Lakeside.

Eligible rivers are managed to retain their status until a suitability determination has been made whether to recommend their inclusion in the National Wild and Scenic Rivers System.

Suitable rivers on the Apache-Sitgreaves NFs include portions of the Blue River and KP Creek (table 2). These rivers were found to be suitable for inclusion in the National Wild and Scenic Rivers System through a separate environmental analysis (Forest Service, 2010b). Suitable rivers are managed to maintain their conditions and values until congressional action is taken. One-half mile wide corridors, one-quarter mile on each side of eligible and suitable rivers, are managed to protect the identified river values.

Table 1. Eligible wild and scenic rivers of the Apache-Sitgreaves NFs by river classification[a]

River Name	Wild (miles)	Scenic (miles)	Recreational (miles)	Total Miles
Bear Wallow Creek	3.7	–	0.9	4.6
Black River	18.3	0.5	–	18.8
Campbell Blue Creek[b]	4.1	–	8.0	12.1
Coal Creek[b]	9.6	0.6	7.7	17.9
Dix Creek	–	3.3	–	3.3
Eagle Creek	–	–	19.5	19.5
East Clear Creek[c]	–	21.2	–	21.2
East Eagle Creek	7.5	3.5	3.5	14.5
East Fork Black River	3.3	1.2	8.2	12.7
East Fork Little Colorado River	–	9.3	–	9.3
Fish Creek	–	9.9	0.6	10.5
Little Blue Creek	18.4	–	–	18.4
Leonard Canyon[d]	–	–	23.6	23.6

[26] Designated wild and scenic rivers are those that are included in the National Wild and Scenic Rivers System.

River Name	Wild (miles)	Scenic (miles)	Recreational (miles)	Total Miles
North Fork East Fork Black River	12.7	1.0	–	13.7
Pigeon Creek	4.8	–	10.3	15.1
San Francisco River	9.0	–	15.0	24.0
Sardine Creek	8.9	–	–	8.9
South Fork Little Colorado River	–	7.3	–	7.3
Turkey Creek	9.1	–	–	9.1
West Fork Black River	8.6	3.0		11.6
West Fork Little Colorado River	6.4	–	1.7	8.1
Willow Creek	18.9	–	-–	18.9
Woods Canyon – Chevelon Creek	28.4	5.3	2.4	36.1
Total Miles	**171.7**	**66.1**	**101.4**	**339.2**

[a] Forest Service, 2009b

[b] Also located on the Gila NF. Total miles shown.

[c] Also located on the Coconino NF. A portion of this river is the boundary between the Apache-Sitgreaves NFs and the Coconino NF. Miles shown are the common boundary.

[d] Also located on the Coconino NF. Miles shown are the common boundary between the Apache-Sitgreaves NFs and the Coconino NF.

Table 2. Suitable wild and scenic rivers of the Apache-Sitgreaves NFs by river classification

River Name	Wild (miles)	Scenic (miles)	Recreational (miles)	Total Miles
Blue River	23.3	4.2	–	27.5
KP Creek	11.3	–	–	11.3
Total Miles	**34.6**	**4.2**	**0.0**	**38.8**

Portions of the eligible West Fork and East Fork Little Colorado Rivers are located within Mount Baldy Wilderness. All of the eligible Bear Wallow Creek is within Bear Wallow Wilderness. There are no eligible or suitable rivers in Escudilla Wilderness. A portion of the suitable Blue River is within the Primitive Area Management Area. Most of the suitable KP Creek is also within the Primitive Area Management Area; the remainder is within the Natural Landscape Management Area. Other eligible rivers are located within a variety of management areas across the forests.

Desired Conditions for Eligible and Suitable Wild and Scenic Rivers

- Eligible and suitable wild river segments display unaltered landscapes where generally only ecological changes occur (very high scenic integrity) and provide primitive and/or semiprimitive nonmotorized recreation opportunities.
- Eligible and suitable scenic river segments display landscapes which vary from slightly altered where human activities may be seen but do not attract attention (moderate scenic integrity) to natural appearing where human activities do not stand out (high scenic integrity) and provide semiprimitive nonmotorized, semiprimitive motorized, and/or roaded natural recreation opportunities.
- Eligible and suitable recreational river segments display landscapes which vary from moderately altered where human activities are evident (low scenic integrity) to slightly altered where human activities may be seen but do not attract attention (moderate scenic integrity) and provide primitive, semiprimitive nonmotorized, semiprimitive motorized, and/or roaded natural recreation opportunities.

Standards for Eligible and Suitable Wild and Scenic Rivers

- Each eligible river's free-flowing condition, outstandingly remarkable values, and classification shall be sustained until further study is conducted.
- Each suitable river's free-flowing condition, outstandingly remarkable values, and classification shall be maintained until congressional action is completed.

Management Approaches for Eligible and Suitable Wild and Scenic Rivers

Where eligible or suitable wild and scenic rivers segments occur (all management areas), the most restrictive management direction applies.

Related Plan Content for Eligible and Suitable Wild and Scenic Rivers

See the following sections: All PNVTs, Wilderness, and Primitive Area.

Scenic Resources

Background for Scenic Resources

The Apache-Sitgreaves NFs contain some of the most scenic landscapes in the State of Arizona ranging from rugged canyons to rolling hills and grasslands to alpine forests. A favorite activity of forest visitors is viewing natural features and wildlife.

Desired Conditions for Scenic Resources

- The Apache-Sitgreaves NFs appear predominantly natural, and human activities do not dominate the landscape.
- The natural and cultural features of the landscapes that provide a "sense of place" are intact.

- Landscapes possess vegetation patterns and compositions that are naturally variable in appearance and contribute to scenic values.
- Visitors have opportunities to experience important scenic elements including fall colors, rolling grasslands, picturesque vistas, and green riparian corridors.
- Lakes (reservoirs) and surrounding lands (¼ mile from the shore) provide landscapes which vary from slightly altered where human activities may be seen but do not attract attention (moderate scenic integrity) to natural appearing where human activities do not stand out (high scenic integrity).
- The scenic vistas associated with canyons and other landforms retain their scenic integrity.
- The vistas—both from and onto—the Mogollon Rim exhibit landscapes which vary from natural appearing where human activities do not stand out (high scenic integrity) to unaltered where generally only ecological changes occur (very high scenic integrity).

Objectives for Scenic Resources

- Annually, accomplish an average of five projects to enhance scenic resources (e.g., restore grasslands and aspen, remove unnecessary fences, close and rehabilitate unneeded gravel/cinder pits).

Guidelines for Scenic Resources

- Constructed features and landscape alterations should be designed to complement the natural setting.
- Projects or activities in primitive and semiprimitive recreation opportunity spectrum (ROS) classes should be designed to maintain a predominately natural appearing environment.

Management Approaches for Scenic Resources

Management emphasis is to maintain the scenic qualities of the Apache-Sitgreaves NFs that contribute to the forests' niche (e.g., rolling grasslands, rugged desert terrain, lush forests, fall colors).

The Scenery Management System (SMS) is a tool for inventorying and managing scenic resources. This system is used to incorporate scenery management principles into the planning, design, and implementation of projects and activities. The scenic integrity objective map can be found in the plan set of documents.

Related Plan Content for Scenic Resources

See the following sections: Grasslands, Landscape Scale Disturbance Events, Scenic Byways, National Recreation Trails, Eligible and Suitable Wild and Scenic Rivers, Livestock Grazing, Minerals and Geology, Special Uses, Community-Forest Intermix, Energy Corridor,

Recommended Research Natural Area, Wilderness, Primitive Area, Recommended Wilderness, and Wildlife Quiet Areas, Natural Landscape, and Research Natural Area.

Community-Forest Interaction

The Apache-Sitgreaves NFs are literally the backyard for many residents of the White Mountains region of Arizona. Many communities adjoin the forests, while the forests completely surround others. Because of this close proximity, many communities and private landowners are directly affected by forest management decisions. These entities, in turn, affect forest management.

There has been a major increase in development on land adjoining and/or surrounded by the Apache-Sitgreaves NFs. Demands related to this growth include access to the forests, utility corridors, roads, special use permits, and recreational opportunities. More and more people are living close to the forests, and managers are challenged to provide goods, services, and access that populations demand, while meeting a variety of user expectations and desires.

Increases in population and housing development may lead to more wildland-urban interface (WUI) areas, loss of open space, and associated use of the Apache-Sitgreaves NFs and demands for services. Forest managers are faced with concerns over available water supply and the preservation of open space (natural areas) around communities.

In general, communities associated with the forests have shifted from a commodity-based economy dependent on logging and grazing to a service-based economy dependent on service, recreation, and construction. However, there continue to be local social and economic dependencies on commodity use and production, which in turn contribute to economic diversity and sustaining the lifestyles and traditions of local communities.

Management emphasis is to build and maintain lasting relationships with local communities, forest users, and tribes. Communication and trust contribute to quality of life, economically stable communities, and healthy forests. A variety of partnerships, including volunteers, are in place to assist in resource management and advancement toward desired conditions. This includes partnerships and relationships among Forest Service, local community groups, and forest permittees.

The Apache-Sitgreaves NFs contribute leadership, organizational skills, facilities, and other resources to communities. Agency personnel are active participants within the communities. These communities benefit economically when the Apache-Sitgreaves NFs and its employees make local purchases for goods and services.

Laws and regulations are enforced so that the Apache-Sitgreaves NFs are available to all persons for legitimate uses with a minimum of restrictions and to promote visitor safety, protect facilities, and cultural and natural resources. There is an emphasis to provide an increased visible presence of uniformed Forest Service employees that help to facilitate law enforcement, deter violations, and provide information to the public. The Apache-Sitgreaves NFs cooperate with State and local law enforcement agencies to protect forest resources, employees, visitors, and property. The forests are responsive and assist with local search and rescue requests.

The Apache-Sitgreaves NFs collaborate with other Federal agencies; tribes; State and local governments; or other interested or affected communities, groups, or persons to better understand climate change across the landscape.

Conservation Education

Background for Conservation Education

The Forest Service has a recognized role and responsibility to educate people about the management and conservation of our Nation's forests and grasslands. Increasing youth and adult knowledge of—and environmental literacy about—forests and natural resources continues to be critical to the accomplishment of the Forest Service mission today.

The Apache-Sitgreaves NFs provide many learning opportunities where participants appreciate the diversity of ecosystems, plants, and wildlife. The conservation education program of the Apache-Sitgreaves NFs includes opportunities for local residents and visitors to learn about the forests. Forest Service employees provide information, lead tours, and participate in local school programs. Interpretive programs are provided in campgrounds and the forests' two visitor information centers, Big Lake and Mogollon Rim. With the help of partners, the forests have been able to expand education opportunities with additional programs (e.g., Kids in the Woods).

The importance of having a viable conservation education program is affirmed. There is a need for the public to understand forest issues, laws, consequences of forest user behavior, and forest management actions.

Desired Conditions for Conservation Education

- The Apache-Sitgreaves NFs provide opportunities for adults and children to explore and learn about ecosystems.
- Forest visitors have access to information about topics of concern related to the Apache-Sitgreaves NFs (e.g., ecosystem restoration, unmanaged recreation, uncharacteristic wildfire), including appropriate visitor behavior (e.g., follow forest orders, pack out trash, appropriate sanitation, wildfire prevention).
- Forest visitors have access to information about the features of the Apache-Sitgreaves NFs, its ecosystems, multiple uses, and other management aspects of the forests.
- Interpretive information (e.g., ecology, wildlife, cultural resources, unique geologic features, Forest Service mission) is available to forest visitors at Apache-Sitgreaves NFs visitor centers, administrative offices, recreation sites, and along major forest roadways.

Management Approaches for Conservation Education

Forest users are informed about the mission of the Forest Service and the benefits derived from authorized land uses. Forest users have access to timely public information (e.g., forest closures, fire danger). Public information, interpretive services, and environmental education programs and activities connect people to the land and to each other. Programs encourage visitors and local residents to take informed actions in sustaining cultural and natural resources. The forests promote established programs (e.g., TreadLightly!®, Leave No Trace, Kids in the Woods, Passport in Time, Bear Aware) that help connect people to nature. A variety of techniques (e.g., handouts, Web site, presentations) are used to educate users on topics ranging from land ethics to forest history. The forests place an emphasis on providing interpretive programs, especially

through its visitor centers (Big Lake and Mogollon Rim) and development of education tools (e.g., invasive species prevention).

Related Plan Content for Conservation Education

See the following sections: Overall Ecosystem Health, Invasive Species, Overall Recreation Opportunities, Cultural Resources, and Wildland Fire Management.

Lands

Background for Lands

Many communities are completely surrounded by the Apache-Sitgreaves NFs and, therefore, are limited in the ability to expand. Forest managers face many challenges associated with growing communities within and adjacent to the forests. Apache-Sitgreaves NFS lands provide less developed opportunities than residents and visitors find in urban settings, such as greenbelts and parks.

Desired Conditions for Lands

- The Apache-Sitgreaves NFs exist in a pattern that promotes efficient management which consists of large contiguous tracts of NFS lands.
- Residents and visitors are aware of Forest Service regulations and respect common property boundaries.
- The construction or placement of fences and gates, structures, signs, or other private personal property on NFS land (occupancy trespass) rarely occurs. Disposal of personal property (e.g., dumping) rarely occurs on NFS lands.

Objectives for Lands

- Annually, survey and post on average 2 to 5 miles of unposted NFS boundary.
- Annually, maintain on average 2 to 5 miles of property boundary posting and corner monuments.
- Annually, resolve an average of three existing trespass cases.

Guidelines for Lands

- Access points to NFS land from adjacent non-NFS developments and subdivisions should be limited and provide all residents (not just edge lot owners) common entry points. Individual access points should be discouraged to minimize the development of unauthorized roads or trails.
- Land exchanges should not result in the creation of isolated NFS parcels surrounded by other ownerships.
- Land acquisitions and exchanges should evaluate, and possibly include, associated beneficial encumbrances (e.g., water rights, mineral rights, easements, instream flow).

Management Approaches for Lands

Land adjustments (e.g., exchanges, purchases) help to consolidate the NFS land base, reduce administrative problems and costs, enhance public access and use, and support resource management objectives. Management emphasis is to work with local communities to understand their community expansion needs and retain access to NFS land. The Apache-Sitgreaves NFs work with communities during development of their master plans and with communities, developers, and homeowner groups to retain legal access to public lands (e.g., easements, trailheads).

In order to reduce trespass issues along property boundaries, education, partnerships, and law enforcement are used. Survey and proper posting of boundaries between NFS lands and other lands is a key objective. Bureau of Land Management (BLM) resurveys are requested where section corners have not been brass capped, especially in areas of complex land patterns, where development is taking place, or where impacted by landscape scale disturbance.

NFS lands that are made available for exchange generally meet one or more of the following criteria: (1) isolated tracts or scattered parcels that cannot be efficiently managed, (2) recreation residence tracts, (3) provide for consolidation of public lands, (4) improve management or benefit specific resources, or (5) overriding public needs.

Lands desirable for acquisition generally meet one or more of the following criteria: (1) lands that contain vital species habitat or vital wildlife habitat (e.g., calving areas, critical winter range); (2) lands needed for developed or dispersed recreation; (3) wetlands, riparian areas, and other water oriented lands; (4) lands that contain unique natural or cultural values; (5) lands that improve public land management, meet specified administrative needs, or benefit other NFS programs; (6) lands that provide needed access, protect public lands from fire or trespass, or prevent damage to public land resources; (7) lands that are needed to consolidate public landownership or meet research needs; (8) lands that are needed to meet programs prescribed or endorsed by acts or reports of Congress or the Department of Agriculture; (9) inholdings that contain needed access; or (10) undeveloped inholdings. When acquired, lands are evaluated for suitability (chapter 4) prior to being allocated for appropriate uses.

Related Plan Content for Lands

See the following section: Community-Forest Intermix.

Cultural Resources

Background for Cultural Resources

The Apache-Sitgreaves NFs' heritage program manages the cultural resources of the forests. The lands of the Apache-Sitgreaves NFs contain a long and diverse cultural record that began approximately 12,000 years ago. Remnants of past and current human activities and events that reflect continuous use by Native peoples and the exploration, settlement, and management by Euro-American cultures can be found throughout the forests. Based on inventory surveys, it is estimated that approximately 100,000 archaeological sites are located on the forests. As of 2011, approximately 385,300 acres had been intensively surveyed for cultural resources resulting in the identification of over 6,900 sites. Many of these sites have been determined as eligible for listing on the National Register of Historic Places (NRHP). At present, 10 properties are listed on the

National Register. The forests also contain cultural landscapes, prehistoric trails, and historic routes and trails.

Properties presently listed on the National Register of Historic Places include Bailey Ruin, Bear Mountain Lookout, Butterfly Lodge, Deer Springs Lookout, Lake Mountain Lookout, Los Burros Ranger Station, Pinedale Ranger Station, Promontory Butte Lookout, PS Knoll Lookout, and Water Canyon Administrative Site.

In addition, lands and resources are considered traditionally significant to all American Indian tribes associated with the lands of the Apache-Sitgreaves NFs: Fort McDowell Yavapai Nation, Hopi Tribe, Navajo Nation, Pueblo of Zuni, San Carlos Apache Tribe, Tonto Apache Tribe, White Mountain Apache Tribe, Yavapai-Apache Nation, and Yavapai-Prescott Indian Tribe, and in some cases, specific resources or areas are considered sacred by one or more tribes. Traditional cultural places and use areas are cultural historic properties that may be eligible to the National Register of Historic Places.

Cultural resources are nonrenewable with few exceptions. Once the resource has been disturbed, damaged, altered, or removed, nothing can recover the information that could have been gained through analysis or replace the opportunity for individuals to understand and experience the site. Forest Service management activities, public use, and natural processes have impacted cultural resources. Damage from vandalism (e.g., pilfering) continues to be a management issue. Current forest management practices minimize or avoid impacts to cultural resources.

Desired Conditions for Cultural Resources

- Significant cultural resources (i.e., archaeological, historic, traditional cultural properties (TCPs), known American Indian sacred sites) are preserved and protected for their cultural importance and are free from adverse impacts.
- Heritage programs, interpretive presentations, brochures, or displays are available to provide opportunities for public use, understanding, and enjoyment of the Apache-Sitgreaves NFs' cultural resources.
- Eligible and historically-significant[27] cultural properties are listed on the National Register of Historic Places (NRHP).

Objectives for Cultural Resources

- Every 2 years or according to Southwestern Region Heritage Program standards, National Register sites and priority cultural resources are inspected.
- During the planning period, nominate at least five eligible cultural resources for inclusion in the NRHP.
- Annually, provide a Passport in Time (PIT) or other education project to provide opportunities for the public to learn about the Apache-Sitgreaves NFs' past and cultural resources.

[27] Significance as defined by the National Historic Preservation Act and 36 CFR § 60.

- Annually, complete a minimum of 100 acres of non-project cultural inventory to expand existing knowledge about the nature, location, and management needs of the forests' cultural resources.

Standards for Cultural Resources

- Human remains shall not intentionally be excavated for educational purposes (e.g., research, field schools).
- Contracts, permits, or leases that have the potential to affect cultural resources shall include appropriate clauses specifying site protection responsibilities and liabilities for damage.

Guidelines for Cultural Resources

- Activities that have the potential to adversely affect cultural resources should be discouraged in areas with a high concentration of significant archaeological sites or in areas of cultural or religious significance[28] to American Indians.
- Avoidance or protection measures should be the preferred method to prevent or minimize adverse effects to cultural resources listed in, nominated to, eligible for, or unevaluated for the NRHP.
- Historic facilities that are eligible for the NRHP should be managed to retain their integrity.

Management Approaches for Cultural Resources

Management emphasis of the heritage resource program includes inventory, protection, study/evaluation, interpretation, and preservation. In addition to law, regulation, and policy, the forests follow the programmatic agreement regarding cultural resources protection and responsibilities executed by the New Mexico, Arizona, Texas and Oklahoma State Historic Preservation Officers (SHPO), the Advisory Council on Historic Preservation, and the Forest Service, Southwestern Region. The forests' heritage program also uses National Register Bulletins and the Forest Service Southwestern Region 1996 document "Cultural Affiliations: Prehistoric Cultural Affiliations of Southwestern Indian Tribes" to assist in complying with law, regulations, policy, and desired conditions.

When resource management conflicts occur, the values of preservation of cultural resources are weighed against the values of the proposed land use. In assessing the priority for preservation of cultural resources, consideration is given to the following: (1) listing on or eligibility for the NRHP; (2) adequacy of present methods of investigation and data recovery to realize the current research potential; (3) likelihood that the resource will have greater importance for addressing future research questions than current ones; (4) presence of values associated with significant historical persons or events, traditional cultural or religious values, or unique interpretive values where those values exist undisturbed in their original context(s); (5) likelihood of disturbing

[28] Sacred sites as defined in E.O. 13007, traditional cultural properties as defined in National Register Bulletin 38, traditional cultural purposes as defined in the 2008 Farm Bill Section 8102, Subtitle B.

historic or prehistoric burials; (6) significance based primarily on architectural character and integrity of the setting; (7) importance of preservation in place relative to the objectives of the State Historic Preservation Plan; and (8) site densities that make data recovery economically infeasible or require unattainable operating conditions. Where preservation in place is important under these conditions, consideration is given to project redesign, relocation, or cancellation. If adverse effects cannot be avoided, they are mitigated per 36 CFR § 800.

Areas rated as highest priority for non-project cultural inventory are those: (1) known or thought to be threatened by looting and/or impacts of visitor use or other forces, (2) expected to have high site densities, and (3) important to understanding the historic or prehistoric occupation of the forests.

Sites that need management or treatment plans are prioritized as follows: (1) sites subject to ongoing impacts or deterioration, (2) sites of high traditional, scientific, or community value, and (3) historic buildings or facilities with high potential for adaptive reuse.

The Apache-Sitgreaves NFs continue to collaborate with other forests, the State Historic Preservation Officer, the public, and affiliated tribes to develop management strategies for the forests' cultural resources, including a forest heritage plan. Scientific studies and research of the forests' heritage collections and resources, including an ethnographic inventory, contribute to tribal knowledge and Forest Service management activities.

Related Plan Content for Cultural Resources

See the following sections: Overall Recreation Opportunities, Dispersed Recreation, Motorized Opportunities, Nonmotorized Opportunities, National Recreation Trails, Conservation Education, American Indian Rights and Interests, Livestock Grazing, Minerals and Geology, Special Uses, Wildland Fire Management, and Community-Forest Intermix.

American Indian Rights and Interests

Background for American Indian Rights and Interests

American Indian tribes are sovereign nations. The United States has a fiduciary relationship with tribal governments as set forth in the U.S. Constitution, treaties, statutes, executive orders, court decisions, and agreements. This relationship is also known as the Federal Trust Duty to American Indians. Therefore, the Forest Service has certain responsibilities to American Indian tribes to fulfill the government's Federal Trust Duty. In meeting these responsibilities, the Forest Service must administer their programs in a manner that does not interfere with tribal rights and resources. When American Indian tribes ceded lands to the United States government, rights and privileges to off-reservation lands were reserved for their tribal members. Culturally affiliated tribes retain rights to use Apache-Sitgreaves NFs' lands in ways that are not allowed to the general public. Access or use by the general public may be temporarily denied to allow tribal members to exercise their rights and interests in privacy and solitude.

Forest managers are required to consult tribes when proposed policies or management actions may affect their interests. Nine federally recognized tribal governments, representing five American Indian tribes, have aboriginal territories and traditional ties to the lands now administered by the Apache-Sitgreaves NFs: Fort McDowell Yavapai Nation, Hopi Tribe, Navajo Nation, Pueblo of Zuni, San Carlos Apache Tribe, Tonto Apache Tribe, White Mountain Apache

Tribe, Yavapai-Apache Nation, and Yavapai-Prescott Tribe. Each tribe has their own history, traditions, and relationship to the land and other groups. The lands and resources of the Apache-Sitgreaves NFs have been used and continue to be used by many of the tribes for a variety of traditional cultural and religious activities. Past and current consultations with tribes have identified places and properties of religious and cultural use. These places are ethnographically important to tribal values and are inseparable from their cultures.

The better known TCPs, sacred sites, or areas known to have been used and/or continue to be used for traditional cultural purposes include, but are not limited to, Escudilla Mountain, Mount Baldy, Greens Peak, Rose Peak, Gobbler Peak, St. Peters Dome, Burro Mountain, Antelope Mountain, Pole Knoll, Flume Mountain, SU Knoll, Head of Chevelon Canyon, Chevelon Butte, areas near Aspen Lake, numerous springs, caves, and the Little Colorado River. Many other areas located on the forests are used for traditional cultural purposes but have not been specifically identified. Additional areas may be identified through project or permit specific tribal consultation. Therefore, the inventory of known TCPs, sacred sites, and areas used for traditional cultural purposes is subject to change, and the list will be updated as needed. Forest managers confer with the forest heritage program manager or forest tribal liaison for more specific information.

Desired Conditions for American Indian Rights and Interests

- Members of affiliated tribes have access to gather forest resources and products for traditional cultural purposes[28]. (e.g., medicinal plants, boughs, basket materials, pollen, plants and minerals for pigments).
- Traditionally used resources are not depleted and are available for future generations.
- Sacred sites and significant TCPs are accessible and free of adverse impacts allowing for culturally affiliated tribes to gather traditional forest products and conduct ceremonies.
- All sacred objects, human remains, funerary objects, and objects of cultural patrimony removed from lands of Apache-Sitgreaves NFs have been repatriated to the appropriate tribe.

Objectives for American Indian Rights and Interests

- Over the planning period, a minimum of five MOUs are renewed or established with tribes associated with the Apache-Sitgreaves NFs.

Guidelines for American Indian Rights and Interests

- Significant TCPs and sacred sites, that are known to be utilized by tribes for traditional use and religious ceremonies, should be managed to preserve the character and use of the site.
- Activities and uses should be administered in a manner that is sensitive to traditional American Indian beliefs and cultural practices.

- Human remains and religious objects recovered from excavations conducted on the forests should be repatriated within 5 years in compliance with the Native American Graves Protection and Repatriation Act of 1990 (Public Law 101-601).

Management Approaches for American Indian Rights and Interests

The Apache-Sitgreaves NFs develop and maintain effective working relationships and recognize American Indian tribal viewpoints. Management actions support the forests' Federal trust responsibilities. Tribes are consulted at the early stages of planning and project design, so that tribal perspectives as well as traditional knowledge can be incorporated into project designs and decisions. Forest managers work with tribes to achieve mutually beneficial desired conditions and objectives.

Agreements are in place for repatriation of human remains and artifacts. The management approach is to ensure the confidentiality of tribal information received by tribes through consultation if requested. The gathering of forest products or temporary closures of forest lands may occur for traditional and cultural purposes if requested by a tribe. These activities are authorized by USC Title 25 Indians, Chapter 32A Cultural and Heritage Cooperation Authority, Sections 3051-3057.

Forest employees receive training so they understand the unique legal relationship between the Federal government and American Indian tribes, set forth in the U.S. Constitution, treaties, statutes, executive orders, and court decisions. Managers may use wildland fire to restore and enhance traditional cultural use areas used for collecting plants. Managers work to resolve conflicts with activities such as mining and drilling, OHV areas, energy corridors, and electronic sites that are generally inconsistent with the desired conditions for TCPs.

Related Plan Content for American Indian Rights and Interests

See the following sections: Overall Recreation Opportunities, Cultural Resources, Forest Products, Special Uses, and Community-Forest Intermix.

Forest Products

Background for Forest Products

Forest products include wood (timber, biomass, firewood) and special forest products. Special forest products include floral greenery, Christmas trees and boughs, mushrooms, wildlings (transplanted trees, shrubs, or herbaceous plants), cones, medicinal plants, cuttings, herbs, nuts, berries, and decorative wood.

The total volume of wood products sold by the Apache-Sitgreaves NFs has fluctuated over time with an overall downward trend since the 1990s. Focus has shifted toward ecological restoration and reduction of wildfire hazard to communities by removing small diameter, insect-infested, and dead and dying trees. The forests encourage new wood product industries to utilize these products. Firewood harvest continues to be an important component of the local social and economic fabric.

Desired Conditions for Forest Products

- The Apache-Sitgreaves NFs provide a sustainable supply of forest products (e.g., small roundwood, sawlogs, biomass, firewood, cones, Christmas trees, wildlings) to businesses and individuals within the capability of the land.
- The collection of live plants, mushrooms, and other forest products does not impact species persistence onsite.

Objectives for Forest Products

- Annually, prepare and offer up to an average of 122,000 CCF[29] from suitable timberlands resulting from sustainable harvest to provide wood products to businesses and individuals.
- Annually, provide up to 94,000 CCF (119,380 cords[30]) of firewood for personal and commercial use.
- Annually, provide an average of 5,000 permits for Christmas trees.

Standards for Forest Products

- Authorizations to cut, collect, or use forest products for any personal, commercial, or scientific purpose (i.e., permits, contracts, agreements) shall include provisions to ensure the needs of wildlife, which depend upon those forest products, will continue to be met (e.g., fungi and cone collection with respect to overwinter forage needs of squirrels).

Guidelines for Forest Products

- Permits issued for forest products should include stipulations to protect resources.

Management Approaches for Forest Products

Wood products are a secondary benefit of treatments that are intended to restore the forests' ecological composition, structure, and function to a healthier, resilient condition. Timber production and tree cutting are used to help achieve vegetation desired conditions, as well as contribute to the local and regional economy. Uneven-aged silvicultural systems are emphasized and even-aged systems are used where appropriate. Tree cutting on lands not suitable for timber production may occur for such purposes as restoration, salvage, fuels management, insect and disease mitigation, protection or enhancement of biological diversity or wildlife habitat, research or administrative studies, or recreation consistent with other management direction.

A variety of partnerships and authorities are used for making forest products available to forest users (e.g., procurement contracts, stewardship contracts, forest products permits). The forests also use the Tribal Forest Protection Act to collaboratively work with adjacent tribal governments

[29] CCF = 100 cubic feet

[30] 1 CCF = 1.27 cords

to carry out restoration projects. Tribes culturally affiliated with lands on the Apache-Sitgreaves NFs may gather trees, portions of trees, or forest products free of charge for noncommercial traditional and cultural purposes.

Figure 9. Small diameter trees to be used for forest products

The forests allowable sale quantity (ASQ) is estimated as an annual average of 122,000 CCF. The ASQ represents the amount of timber (not including firewood or nonindustrial wood) that may be sold from lands suitable for timber production. Wood from nonsuitable timberlands would also be available.

Other desired forest products, such as house logs, are available through permits or small sales. Areas may be identified for forest product removal (e.g., Christmas tree, firewood). Woody biomass not removed by project operations may be made available to meet public or industry needs. Plan direction and interdisciplinary input are used to develop additional project specific and/or resource specific conditions to be included in all forest product permits and contracts issued.

Related Plan Content for Forest Products

See the following sections: Overall Ecosystem Health, All PNVTs, Forests: All Forested PNVTs, Woodlands: All Woodland PNVTs, Wildlife and Rare Plants, American Indian Rights and Interests, Landscape Scale Disturbance Events, and Special Uses.

Livestock Grazing

Background for Livestock Grazing

As of 2014, the Apache-Sitgreaves NFs administer 92 active grazing allotments and two designated sheep driveways. Livestock grazing contributes to the livelihood of the permittees and to the economy of local communities and counties. Livestock numbers have declined over the last 20 years, as the forests have balanced permitted numbers with the capacity of the land while responding to environmental changes such as drought. Over the last decade, the forests have worked with partners and permittees to reduce grazing pressure on sensitive areas (e.g., critical areas, riparian areas).

Desired Conditions for Livestock Grazing

- Livestock grazing contributes to the social, economic, and cultural diversity and stability of rural communities.
- Livestock grazing and associated activities occur such that healthy, diverse plant communities, satisfactory condition soils, and wildlife habitat are maintained or improved.
- Range developments for livestock minimize impacts to wildlife and blend with the natural environment.

- Livestock grazing is in balance with available forage (i.e., grazing and browsing by authorized livestock, wild horses, and wildlife do not exceed available forage production within established use levels).
- Livestock grazing and associated activities do not negatively impact cultural resources.

Standards for Livestock Grazing

- New or reconstructed fencing shall allow for wildlife passage, except where specifically intended to exclude wildlife (e.g., elk fencing).
- New livestock watering facilities shall be designed to allow wildlife access and escape.

Guidelines for Livestock Grazing

- During maintenance of existing watering facilities, escape ramps that are ineffective or missing should be replaced.
- Critical areas should be managed to address the inherent or unique site factors, condition, values, or potential conflicts associated with them.
- Grazing use on seasonal allotments should be timed to the appropriate plant growth stage and soil moisture.
- New livestock troughs, tanks, and holding facilities should be located out of riparian areas to reduce concentration of livestock in these areas. Existing facilities in riparian areas should be modified, relocated, or removed where their presence is determined to inhibit movement toward desired riparian or aquatic conditions.
- As areas are mechanically treated or burned, or after large disturbances, timing of livestock grazing should be modified as needed, in order to move toward desired conditions and to accomplish the objectives for the treatment or disturbed area.
- Forage, browse, and cover needs of wildlife, authorized livestock, and wild horses should be managed in balance with available forage so that plants providing for these needs remain at or move toward a healthy, persistent state.
- Efforts (e.g., temporary fencing, increased herding, herding dogs) should be made to prevent transfer of disease from domestic sheep and goats to bighorn sheep wherever bighorn sheep occur. Permit conversions to domestic sheep or goats should not be allowed in areas adjacent to or inhabited by bighorn sheep.
- To minimize potential resource impacts from livestock, salt or nutritional supplements should not be placed within a quarter of a mile of any riparian area or water source. Salt or nutritional supplements should also be located to minimize herbivory impacts to aspen clones.
- To prevent resource damage (e.g., stream banks) and disturbance to federally listed and sensitive wildlife species, trailing of livestock should not occur along riparian areas. Where no alternative route is available, approval may be granted where effective mitigation measures are implemented (e.g., timing of trailing, number of livestock trailed at one time).

- Constructed features should be maintained to support the purpose(s) for which they were built. Constructed features should be removed when no longer needed.
- New range developments should be located to minimize impacts to scenic resources and reduce the potential for vandalism and livestock-vehicle conflicts. Range developments should be designed in consideration of public safety, especially in areas of concentrated recreation use.

Management Approaches for Livestock Grazing

The management approach is to improve or maintain the health of rangelands by completing site-specific NEPA environmental analyses, assessments, and decisions and updating allotment management plans for individual grazing allotments to emphasize the achievement of desired conditions. Sustainable stocking levels, mitigation measures, and appropriate grazing systems are tools utilized to that end.

Forest managers work with permittees to adjust timing, intensity, and frequency of livestock grazing to respond to changing resource conditions. Livestock and associated developments are managed to minimize impacts to forest resources, including cultural resources, native plant and animal species, wetlands, springs, seeps, karst and riparian areas. Vacant allotments or pastures are stocked or withdrawn from grazing when necessary to benefit other resource needs. Vacant allotments or pastures are evaluated for consistency with, and trend toward, plan desired conditions prior to renewing use, with consideration of suitability (chapter 4) for appropriate uses. The Congressional Grazing Guidelines (FSM 2320 – Wilderness Management, section 2323.33 – exhibit 01) are used to manage livestock grazing in wilderness and primitive areas.

The Apache-Sitgreaves NFs work with permittees, the State, tribes, and other organizations to maintain or improve rangeland conditions. The forests work with the Tonto National Forest, AZGFD, sheep permittees, and other permittees to administer the Heber-Reno and Morgan Mountain sheep driveways. Range developments are maintained on an annual basis so as to not be a hazard to wildlife. Forest managers also work with non-permittee livestock owners to prevent unauthorized livestock use, including reconstructing fencing where needed.

Because drought is inevitable in the Southwest, livestock grazing management on the Apache-Sitgreaves NFs incorporates, as necessary, (1) evaluation of drought conditions, (2) drought management relative to vegetation impacts, (3) stocking during and after drought, and (4) early and effective communications with all affected parties.

Related Plan Content for Livestock Grazing

See the following sections: Overall Ecosystem Health, Aquatic Habitat and Species, Riparian Areas, Forests: Aspen, Grasslands, Wildlife and Rare Plants, Scenic Resources, Cultural Resources, and Wild Horse Territory.

Minerals and Geology

Background for Minerals and Geology

The potential for locatable and leasable minerals is low because of the existing geological makeup of the forests. Numerous active mining claims for locatable sandstone are found on the

Lakeside and Black Mesa Ranger Districts. Also, several mill site claims are located on the Clifton Ranger District. A large copper deposit and open pit copper mine exist just south of the forests' boundary near Morenci, Arizona. There may be some abandoned mines on Apache-Sitgreaves NFS lands that need closure. A number of small abandoned surface operations and test pits are scattered across the forests and are not regarded as hazardous.

Common variety minerals include sand, gravel, landscape rock, cinders, and crushed rock. The demand for these mineral materials from the Apache-Sitgreaves NFs is low. Permitted uses are predominantly small private sales from common use pits, a multi-operator commercial pit, and various pits for State and county road uses (primarily for road cinders).

Karst features are located primarily on the Black Mesa Ranger District. They are geological landforms that predominantly result from shaping processes controlled by soluble bedrock, usually limestone. Karst landscape is characterized by closed depressions, disappearing streams, and solutional shaping. Karst features create unique microhabitats and are important areas for rapid subsurface drainage and aquifer recharge.

Desired Conditions for Minerals and Geology

- Mineral developments, including pits, mines, equipment, and associated structures, do not dominate the scenic landscape.
- Mineral materials (e.g., gravel, cinders) are available for road maintenance activities for the Forest Service transportation system, public road system, and ADOT use.
- Mineral materials (e.g., cinders, decorative stone) are available to support resource management needs, personal use, and commercial pursuits.
- Lands where past mineral development or exploration has occurred are returned to stable conditions and vegetated with native species.
- Abandoned mine lands do not endanger people or the environment.
- Naturally occurring geological features (e.g., caves, sinkholes) remain intact to support wildlife habitat, recreation opportunities, and unique vegetation.
- Both caves and abandoned mines are available for roosting bats, reducing the potential for displacement, abandonment of young, and possible mortality.
- Archaeological, geological, and biological features of caves and abandoned mines are not adversely affected by visitors.

Guidelines for Minerals and Geology

- Key cultural sites, research natural areas, and administrative and recreation sites with an investment in facilities should be withdrawn from mineral entry to protect resources and existing infrastructure.
- Mineral material resource sites should be located where economical and the scenic integrity objectives can be met. Adverse visual impacts should be minimized.

- Existing designated mineral material collection areas and community pits should be utilized to the maximum before new areas are developed. Additional mineral material development should balance private and community needs while providing for sustainable administrative use.
- Abandoned mine lands or unneeded mineral material pits should be restored, closed, or rehabilitated to provide for resource protection and public health and safety.
- Streambed and floodplain alteration or removal of material should not occur if it prevents attainment of riparian, channel morphology, or streambank desired conditions.
- To reduce disturbances from human activities and prevent the spread of disease, bat gates should be constructed and installed in cave and mine entrances used as shelter for bats within 3 years of discovery when there are no conflicts with cultural resources.
- Caves and abandoned mines that are used by bats should be managed to prevent disturbance to species and spread of disease (e.g., white-nose syndrome).
- Active mineral operations should be managed to deter public motorized vehicle travel for public safety.
- Oil and geothermal leases should contain the “no surface occupancy” restriction in designated[31] or recommended special areas (e.g., recommended wilderness, primitive area, eligible or suitable wild and scenic rivers corridors, research natural areas, botanical area, and wild horse territory), sacred sites, American Indian TCPs, and properties on the National Register of Historic Places to protect the unique character of these areas.
- Common variety mineral activities should not be permitted in designated or recommended special areas or Chevelon Canyon to protect the unique character of these areas.

Management Approaches for Minerals and Geology

The Apache-Sitgreaves NFs cooperate with the State and other agencies to inventory, mitigate, and rehabilitate hazardous abandoned mines and mined areas. As abandoned mine land hazards (e.g., adits, drifts, portals, shafts) are identified and inventoried, appropriate long-term management and closure is considered. Pit plans provide detailed management direction for mineral material pits.

Strategies to protect cave and karst resources include use of best management practices and site-specific design features such as activity buffers that prevent silt, sediment, and debris from flowing into karst features. Cave and karst management plans are developed as needed.

Some gravel and cinder pits are managed for very low scenic integrity and may dominate the landscape when viewed from nearby.

[31] Designated wilderness is withdrawn from leasing and mineral entry.

Related Plan Content for Minerals and Geology

See the following sections: Wildlife and Rare Plants, Scenic Resources, Cultural Resources, and Special Uses.

Special Uses

Background for Special Uses

Occupancy and use of NFS lands for public and private purposes, where the use is consistent with natural resource management goals, occur through the issuance of special use authorizations and easements. A wide range of uses may be permitted including, but not limited to, water storage and transmission, electric transmission and distribution lines, communications sites, alternative and renewable energy generating facilities, research permits, resorts, organization camps, outfitters and guides, recreational events, and large group gatherings.

Increased demand is expected for additional utility lines and renewable energy sources to serve the growing populations of Arizona and the Southwest. There are three major energy transmission corridors, two on the Black Mesa Ranger District and one on the Clifton Ranger District. See the “Energy Corridor Management Area” section for direction specific to these three corridors.

Desired Conditions for Special Uses

- Energy developments and other special uses are not major features on the landscape and should not attract attention (moderate scenic integrity).
- Lands where special use activities have occurred show little evidence of impacts.
- Communications sites display landscapes which vary from moderately altered where human activities are evident (low scenic integrity) to slightly altered where human activities may be seen but do not attract attention (moderate scenic integrity).

Standards for Special Uses

- Noxious plants and nonnative invasive species monitoring and control shall be included in contracts, permits, and agreements.
- Special use authorizations for the collection of live species with limited distribution (e.g., some invertebrates, plants) shall include permit provisions to ensure the species persist onsite.
- New communications sites or energy developments shall not be authorized on traditional cultural properties.

Guidelines for Special Uses

- Special use authorizations should include provisions that limit encumbrances of NFS land.
- The number of communications sites, energy developments, and energy corridors should be minimized to limit encumbrances of NFS land.

- New communications permittees and equipment should be located or colocated within designated communications sites as identified in appendix C.
- New communications sites, energy developments, and energy corridors should be located to minimize impacts to scenery, special areas, and species.
- Commercial use of Forest Service administrative communications sites should be discouraged to avoid potential use conflicts or communication interference.
- High power antenna/towers should not be authorized except for the existing antenna/tower located on Porter Mountain. Upon termination of the Porter Mountain high power permit, or in the case of inoperability, this communications site should be managed as low power.
- Existing energy corridors should be used to their capacity with compatible upgraded power lines before evaluating new routes.
- Environmental disturbance should be minimized by colocating pipelines, power lines, fiber optic lines, and communications facilities.
- Power pole installation or replacement under special use authorization should include raptor protection devices in open habitat such as large meadows and grasslands. Raptor protection devices should be installed on existing poles where raptors have been killed.
- The use of underground utilities should be favored to avoid potential conflicts with resources (e.g., scenic integrity, wildlife, wildfire, heritage).
- Water use associated with special use authorizations should be in accordance with Arizona State Statutes and should have a decreed water right or a valid claim.
- Target ranges may be appropriate in the General Forest or Community-Forest Intermix Management Areas because of the wide spectrum of recreation opportunities that can be provided in these areas. Other management areas should be avoided.
- Constructed features should be maintained to support the purpose(s) for which they were built. Constructed features should be removed when no longer needed.
- As applicable, issuance of special use authorizations should incorporate measures to reduce potential impacts to wildlife and avoid rare and unique habitats (e.g., bogs, fens).
- Commercial outfitters and guides should not be authorized to use developed campgrounds so those sites remain available for noncommercial forest visitors.
- Commercial outfitters and guides may be authorized use of range developments when there is no conflict with allotment management.
- Large group and recreation event special uses should not be authorized within wilderness, recommended wilderness, primitive area, wildlife quiet areas, eligible “wild” river corridors, riparian and wetland areas, cultural resource sites, Phelps Cabin Botanical Area, Phelps Cabin Research Natural Area, or recommended research natural areas to protect the unique character of these areas.

Management Approaches for Special Uses

Special use authorizations are considered for uses that complement other opportunities and are based on public need or cannot be met on private or other Federal lands. Timeliness of processing special use requests is based on agency capacity (available funding and staffing). The cost of processing special use permits may be recovered from the proponent where authorized and used to process permits and monitor compliance. Forest users should have information regarding when there is a need to obtain a permit, particularly for collection of forest products.

Developed energy corridors are managed for very low scenic integrity where vegetation and structural changes may attract attention and dominate the landscape when viewed from nearby.

Requests for energy development and transmission corridors are evaluated based on public need, economics, and environmental impacts of the alternatives. Emphasis is to use existing corridors to their capacity with compatible utilities, including upgrade of existing power lines, before evaluating new routes. To minimize impacts to wildlife, managers consider current U.S. Fish and Wildlife Service and Arizona Game and Fish Department guidelines for energy development.

Site plans for the forests' communications sites provide detailed management direction, including scenery management. The forests have over 35 communications sites (see appendix C), both commercial and administrative, where authorized telecommunications facilities are located. There are no plans to add additional communications sites.

The Forest Service is responsible for obtaining compliance of special use authorization requirements (permit terms and conditions) that would impose restrictions or limitations on water diversion, storage, or use not within the jurisdiction of the Arizona Department of Water Resources.

Public road agencies (agencies that maintain roads with gas tax funding) are encouraged to accept USDA easements on roads they maintain and/or provide access to private properties. Where feasible, road use permits issued to public road agencies may be converted to easements as opportunities arise. Managers coordinate with ADOT on management of vegetation in highway rights-of-way to limit the spread of noxious weeds and nonnative invasive plants through appropriate timing of treatments.

Related Plan Content for Special Uses

See the following sections: Water Resources, Invasive Species, Scenic Resources, Lands, Cultural Resources, Wilderness, Primitive Area, and Recommended Research Natural Areas.

Water Uses

Background for Water Uses

Demand for water exceeds supply, except during exceptionally wet years when the amount of water produced exceeds downstream storage capacity. The forests' demand for water is very small compared to downstream users but is extremely important for proper resource management. The demands for Federal reserved water rights for administrative sites, road construction and watering, and firefighting are expected to increase.

All new water acquisitions require either application to the State of Arizona or purchase from other water users. In some basins, the forests may have water rights, but the rights may need to be severed and transferred to other locations within the basin to meet management needs. The forests are directed to follow State water rights laws and policies.

Desired Conditions for Water Uses

- Water developments contribute to fish, wildlife, and riparian habitat as well as scenic and aesthetic values.
- Apache-Sitgreaves NFs water rights are secure and contribute to livestock, recreation, wildlife, and administrative uses.
- Surface water is not diminished by groundwater pumping.
- Dams, diversions, or other water control structures are designed, maintained, and operated to conserve water resources.

Objectives for Water Uses

- Annually, prepare at least one instream flow water rights application until water acquisition needs are complete to sustain riparian areas, fish, wildlife, and water-based recreation.

Standards for Water Uses

- Forest Service water rights must be put to beneficial use and that use documented and consistent with ADWR regulations.
- Special uses for water diversions shall maintain fish, wildlife, and aesthetic values and otherwise protect the environment.
- Streams on NFS lands with high aquatic values and at risk from new water diversions shall be preserved and protected with instream flow water rights.
- Groundwater withdrawals shall not measurably diminish surface water flows on NFS lands without an appropriate surface water right.

Guidelines for Water Uses

- Constructed features should be maintained to support the purpose(s) for which they were built. Constructed features should be removed when no longer needed.

Management Approaches for Water Uses

Management emphasis is to provide adequate water supplies to support the mission of the Agency in addition to helping maintain continuous water supplies to downstream users on and off the forests including small communities located adjacent to the Apache-Sitgreaves NFs. Instream flows are protected or enhanced to achieve resource needs in accordance with State and Federal procedures.

The forests participate in water rights adjudications, maintain a water rights and water uses database, and honor the water rights of others. Forest personnel work with legal water right holders to help conserve water through terms and conditions of permits or easements to capture and transmit water on or across public lands. The forests work with the State and other agencies to deal with groundwater issues and maintain instream flows. The forests work with affected members of the public to gain their support for instream flows.

Project level analysis (e.g., compliance with the National Environmental Policy Act of 1970 (Public Law 91-190)) for new water developments or reissuances includes an assessment of Forest Service water needs with an inventory of existing water rights and water uses within the subwatershed (6th level HUC) of the subject water development. The Apache-Sitgreaves NFs seek to conserve water through better education of water users (e.g., recreationists, permittees) on conservation measures and by applying good water management practices (e.g., preserve water by identifying and reducing leaks) as they relate to diversion and storage operations. Groundwater is critical to maintaining flow in some of the most important streams in the State (e.g., Chevelon Creek and Tonto Creek). Groundwater recharge occurs in higher elevations and is critical to long term maintenance of the resource.

Related Plan Content for Water Uses

See the following sections: Water Resources, Aquatic Habitat and Species, and Special Uses.

Wildland Fire Management

Background for Wildland Fire Management

Fire has played an important ecological role in shaping the vegetation on the Apache-Sitgreaves NFs. The PNVTs are adapted to recurring wildfires started by lightning from spring and early summer thunderstorms. The condition and structure of several PNVTs have changed from reference conditions and, as a result, are departed from desired conditions. More information about ecological conditions can be found in the background sections for each PNVT.

There are five natural fire regimes based on average number of years between fires (fire frequency) combined with the severity of the fire on the dominant overstory vegetation (see table 3 below). They are:

- **Fire regime I:** 0- to 35-year frequency and low (surface fires most common) to mixed severity (less than 75 percent of the dominant overstory vegetation replaced);
- **Fire regime II:** 0- to 35-year frequency and high (stand replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced);
- **Fire regime III:** 35- to 100+-year frequency and mixed severity (less than 75 percent of the dominant overstory vegetation replaced);
- **Fire regime IV:** 35- to 100+-year frequency and high (stand replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced);
- **Fire regime V:** 200+-year frequency and high (stand replacement) severity.

Table 3. Fire regimes by PNVTs on the Apache-Sitgreaves NFs

PNVT	Fire Regime
Ponderosa Pine Forest	I
Dry Mixed Conifer Forest	I
Wet Mixed Conifer Forest[a]	III
Spruce-Fir Forest	III, IV
Madrean Pine-Oak Woodland	I
Piñon-Juniper Woodland[b]	I, II, III, IV, V
Interior Chaparral	IV
Great Basin Grassland	I
Semi-desert Grassland	I, II
Montane/Subalpine Grasslands	I, II
Cottonwood-Willow Riparian Forest[c]	I, III
Mixed Broadleaf Deciduous Riparian Forest[c]	I, III
Montane Willow Riparian Forest[c]	I, III
Wetland/Cienega Riparian Areas[c]	I, III

[a] Within wet mixed conifer, fire regime IV and V may occur; however, it is rare.

[b] Within piñon-juniper, fire regime I is found in piñon-juniper savanna; II, III, IV, and V are found in piñon-juniper persistent woodland.

[c] Wetland/cienega riparian areas and mixed broadleaf deciduous, montane willow, and cottonwood-willow riparian forests' historic and current fire return intervals are strongly influenced by surrounding PNVTs and their fire regime.

Today, the Apache-Sitgreaves NFs contain many more young trees and changes in species composition in all PNVTs than were historically present. With more continuous canopy cover, ladder fuels, and accumulated live and dead woody material, the probability of large, uncharacteristic, stand-replacing fires continues to increase. These fires burn with more intensity and severity; cause higher tree mortality; degrade watersheds; sterilize soils; and threaten adjacent communities, forest infrastructure, and wildlife habitat. Examples of uncharacteristic wildfires include the 2002 Rodeo-Chediski Fire and 2011 Wallow Fire.

Guidance for the Implementation of Federal Wildland Fire Management Policy (Forest Service and DOI, 2009) provides for the consistent implementation of the 1995/2001/2003 Federal Fire Policy. Wildland fire is defined as any non-structure fire that occurs in the wildland; it is categorized into two distinct types:

- Wildfires – Unplanned ignition of a wildland fire (e.g., fires caused by lightning or unauthorized and accidental human-caused fires) and escaped prescribed fires.
- Prescribed fires – Planned ignitions.

Federal fire policy requires that every area with burnable vegetation have a fire management plan (FMP). FMPs are strategic plans that outline a program to manage wildfires and prescribed fires

within the planning area. FMPs and their associated programs and activities support the implementation of land management plans. FMPs are designed to adapt to changing conditions.

The Apache-Sitgreaves NFs' FMP provides for firefighter and public safety first; includes fire management strategies, tactics, and alternatives; and addresses values to be protected and public health issues. The FMP helps guide fire managers in wildland fire decisionmaking.

When appropriate weather and fuel moisture conditions exist, use of wildland fire is a cost-effective way to reduce the likelihood of uncharacteristic fire. The risk of uncharacteristic fire can be reduced when fires occur within historic fire regimes.

To achieve ecosystems that are resilient to fire disturbance, vegetation structure needs to be more consistent with desired conditions. In addition to fire treatments, activities such as thinning and tree harvesting are needed to reduce tree density and canopy cover and support the natural fire regime. Strategic placement and design of these treatments is key to minimizing the impact from fire on values to be protected more efficiently because these activities are costly and there is limited capacity to implement them.

Desired Conditions for Wildland Fire Management

- Human life, property, and natural and cultural resource are protected within and adjacent to NFS lands.
- Wildland fires burn within the range of frequency and intensity of natural fire regimes. Uncharacteristic high severity fires rarely occur and do not burn at the landscape scale.
- Wildland fire maintains and enhances resources and functions in its natural ecological role.
- For all PNVTs, the composition, cover, structure, and mosaic of vegetative conditions reduce uncharacteristic wildfire hazard to local communities and forest ecosystems.

Guidelines for Wildland Fire Management

- Wildland fire may be used to meet PNVT desired conditions and enable natural fire regimes.
- Human-induced impacts (e.g., smoke production, suppression actions) to natural processes, resources, or infrastructure attributable to wildland fire activities should be managed towards achieving objectives as identified in the applicable decision document.
- Resources and infrastructure (e.g., fences, roads, stock tanks) that are lost or damaged by prescribed fire, use of wildland fire, or any suppression activities should be stabilized and rehabilitated.
- Firelines, helispots, and fire camps should be located to avoid disturbance to critical species and impacts to cultural resources.

- Aerial retardant drops should avoid threatened, endangered, proposed, or candidate, identified sensitive species, and waterways[32].

Management Approaches for Wildland Fire Management

Wildland fire objectives are based on factors such as movement of PNVTs toward desired conditions, fuel conditions, current and expected weather and fire behavior, topography, resource availability, and values to be protected. Social and economic considerations (e.g., smoke) may also affect objectives, as well as adjoining jurisdictions having similar or differing missions and directives.

Wildfires may be concurrently managed for one or more objectives (e.g., protection, resource enhancement) that can change as the fire spreads across the landscape. Strategies chosen for wildfires include interdisciplinary input to assess site-specific values to be protected. These strategies are used to develop incident objectives and courses of action to enhance or protect those values. Managers use a decision support process[33] to guide and document wildfire management decisions that provide for firefighter and public safety, minimize costs and resource damage, and are consistent with values to be protected and management objectives. For prescribed fires, the decision document is the signed NEPA decision. To meet the plan’s treatment objectives using prescribed fires, site-specific burn plans are developed which guide implementation. All prescribed fires are conducted in accordance with the Arizona Smoke Management Plan, administered by ADEQ, to comply with the Clean Air Act.

Wildland fire is one tool in the process of restoring the forests’ fire-adapted ecosystems; in areas departed from desired conditions, the use of fire is often most effective when combined with mechanical treatments that further restore forest structure[34]. Mechanical treatments are costly, so the capacity to implement such treatments across the landscape is limited. Strategic placement and design of mechanical treatments increases their effectiveness in protecting values to be protected.

Wildland fire may be the only viable tool in areas such as steep rugged terrain or remote areas where mechanical treatments are not feasible. Objectives in these areas may include higher fire intensities and higher levels of mortality to achieve vegetation structural changes that would not occur through other means to move toward desired conditions. Fuels specialists and silviculturists, along with other resource specialists, work to ensure land management objectives are met. Joint silviculture prescriptions and burn plans may be produced.

Management of wildland fire is coordinated across jurisdictional boundaries whenever there is potential for managing a wildfire or a prescribed fire on more than one jurisdiction (e.g., other national forests, tribal lands, State lands). This is done with the understanding that fire-adapted ecosystems transcend jurisdictional boundaries.

---

[32] See the Nationwide Aerial Application of Fire Retardant on National Forest System Land. Final Environmental Impact Statement. USDA Forest Service for species-specific information including which individual sensitive species are identified.

[33] The decision support system currently being used is the Wildland Fire Decision Support System.

[34] See Standard Management Practices for Site-Specific Project Planning and Implementation table in appendix B for how prescribed fire can be integrated with other silvicultural treatments at the project level.

Three community wildfire protection plans (CWPPs) cover over 895,000 acres of WUI on Federal, State, county, and private lands and include 36 communities within the Apache-Sitgreaves NFs' boundary. These plans identify and prioritize areas for treatment based on input from communities and multiple stakeholders. These plans help determine treatment priorities.

Related Plan Content for Wildland Fire Management

See the following sections: Overall Ecosystem Health, Air, All PNVTs, Landscape Scale Disturbance Events, Conservation Education, Scenic Resources, and Community-Forest Intermix Management Area.

Chapter 3. Management Area Direction

Management areas are areas that have similar management intent and a common management strategy. The plan decisions and other content are described for each management area in this chapter. See chapter 1 for descriptions of plan decisions and other content. This direction does not substitute for, or repeat, forestwide direction. In the event that a plan decision in this section and the plan decision in another section conflict, a project or activity level evaluation may be required to resolve the conflict; generally the more restrictive plan decision prevails. Plan decisions apply to projects or activities where site conditions provide an inherent capability to meet those plan decisions.

> Plan decisions for management area direction are displayed in shaded boxes to distinguish them from other sections of the plan.

Plan decisions and other content for forestwide direction (chapter 2) and suitability (chapter 4) should also be consulted.

Twelve management areas have been identified and are listed in table 4 below. Several management areas are designated special areas, such as wilderness. These are places that have been designated by statute or through past administrative process because of their unique or special characteristics. In addition, there are two categories of preliminary administrative recommendations that occur as separate management areas (recommended research natural areas and recommended wilderness). Those areas recommended for designation are managed to protect their special characteristics until a decision on the designation is made. Table 4 shows the different management areas on the Apache-Sitgreaves NFs. Maps of the management areas can be found in appendix F.

Table 4. Management areas of the Apache-Sitgreaves NFs (acres of NFS land)

Management Area	Size (acres)
General Forest	1,224,071
Community-Forest Intermix	60,564
High Use Developed Recreation Area	16,549
Energy Corridor	2,547
Wild Horse Territory	18,761
Wildlife Quiet Area	50,173
Natural Landscape	404,802
Research Natural Area	261
Recommended Research Natural Area	7,814
Wilderness	23, 234
Primitive Area	199,502
Recommended Wilderness	7,074

General Forest

Background for General Forest

The General Forest Management Area encompasses the majority of the Apache-Sitgreaves NFs. All PNVTs occur in this management area. This area is capable of providing a variety of forest products—both commercial and noncommercial—that may contribute to local and regional communities. The management area contains undeveloped areas as well as developed facilities and open roads and trails. It also contains special areas including eligible and suitable wild and scenic rivers, national recreation trails, and scenic byways. The scenery in some parts of this area may reflect an intensively managed landscape where human influence is evident.

Desired Conditions for General Forest

- Watershed condition rating is at satisfactory.
- Landscapes in the General Forest Management Area vary from moderately altered where human activities are evident (low scenic integrity) to natural where generally only ecological changes occur (very high scenic integrity).
- Recreation opportunities range from semiprimitive nonmotorized to rural.

Management Approaches for General Forest

The emphasis of this area is to restore priority 6th level HUC watersheds, restore fire-adapted ecosystems, reduce the threat of uncharacteristic wildfire, and provide forest products. A wide variety of management activities occur and a wide variety of forest products are available within this management area. Lands identified as suitable for timber production have a regularly scheduled harvest of commercial timber.

Related Plan Content for General Forest

See all resource and special area (Scenic Byways, National Recreation Trails, Eligible and Suitable Wild and Scenic Rivers) sections listed in chapter 2.

Community-Forest Intermix

Background for Community-Forest Intermix

The Community-Forest Intermix Management Area consists of National Forest System (NFS) lands that are within one-half mile of communities-at-risk. Due to the threat of fire moving into or from developed areas, more intensive treatments (including regular maintenance) may be needed to reduce the risk of uncharacteristic wildfire and restore fire-adapted ecosystems. This management area may act as a zone in which fire suppression activities can be safely and effectively conducted. Likewise, it can act as a buffer to protect forest resources.

The Community-Forest Intermix Management Area makes up a portion of the wildland-urban interface (WUI). The WUIs were identified in community wildfire protection plans (CWPPs) and may be located in several management areas. A WUI includes areas around human development at imminent risk from wildfire.

Desired Conditions for Community-Forest Intermix

- The Community-Forest Intermix Management Area is composed of smaller groups of trees that are more widely spaced than other forested areas. These conditions result in fires that burn primarily on the forest floor and rarely spread as crown fire.
- There is legal and adequate access to public lands for resource management and recreation.
- As a result of forest management, most wildfires are low to mixed severity surface fires resulting in limited loss of structures or ecosystem function.
- Residents and visitors are knowledgeable regarding wildfire protection of their homes and property, defensible space, and appropriate uses of the forests.
- These areas provide a safer firefighting environment than the general forest.
- Native grasses, forbs, shrubs, and litter (i.e., fine fuels) are abundant enough to maintain and support natural fire regimes, protect soils, and support water infiltration.
- The composition, density, structure, and mosaic of vegetative conditions reduce uncharacteristic wildfire hazard to local communities and forest ecosystems.
- Ponderosa pine and dry mixed conifer forest structure is similar to forestwide conditions or is composed of smaller and more widely spaced tree groups than in the general forest.
- Wet mixed conifer and spruce-fir forests are growing in an overall more open condition than the wet mixed conifer forest outside of the Community-Forest Intermix Management Area. These conditions result in fires that burn primarily on the forest floor and rarely spread as crown fire.
- Where potential occurs, pure deciduous stands (e.g., aspen, Gambel oak) act as natural firebreaks and enhance scenery.
- Grasslands have less than 10 percent woody canopy cover.
- Piñon-juniper stands have open canopy conditions.
- The integrity of riparian areas is maintained.
- Vandalism and pilfering of cultural resources are uncommon.
- Landscapes in the Community-Forest Intermix Management Area vary from moderately altered where human activities are evident (low scenic integrity) to natural appearing where human activities do not stand out (high scenic integrity).
- Recreation opportunities range from roaded natural to rural.

Guidelines for Community-Forest Intermix

- Unauthorized infrastructure should be removed.
- To reduce fire hazard and spread of insects and disease onto adjacent lands, slash should be treated (e.g., removal, pull back, relocation, burned) as soon as possible.

- Where more than 80 percent of the host species or 90 percent of the area is infected with dwarf mistletoe (if regeneration or deferred treatment is not feasible), then thinning from below and/or prescribed fire should be used as needed for fire hazard reduction.
- Due to the greater values to be protected (e.g., homes, property), tree basal areas should be at the lower end of the desired range and openings should occur at the higher end of the desired range (as described in the applicable PNVT desired conditions).
- Retention of fire-resistant tree species (e.g., ponderosa pine, Douglas-fir, pure aspen) should be emphasized in the wet mixed conifer and spruce-fir forested PNVTs to reduce fire hazard.

Management Approaches for Community-Forest Intermix

Forest managers work toward achieving the goals outlined in the CWPPs for the counties within the Apache-Sitgreaves NFs. Within this management area, these include the CWPP for At-Risk-Communities in Apache County, and the Sitgreaves CWPP (includes Apache, Coconino, and Navajo Counties).

Figure 10. Treated area within the CFI that survived the 2011 Wallow Fire

Treatments may occur more often than in other management areas. Both mechanized methods and prescribed fire may be used regularly. A higher degree of temporary ground disturbance may occur. The amount of snags and residual large coarse woody debris is generally lower than in the General Forest Management Area. In addition, forest openings are larger and basal areas are lower than in the General Forest Management Area. The management approach within this management area is to complete initial treatments to reduce fire hazard. Once initial treatments are complete, the focus is to maintain the investment and desired conditions primarily through prescribed fire and mechanical treatments. Other objectives may also be considered.

Best available control technologies are used to limit smoke impacts from forest management activities. Forest managers coordinate with adjacent land management agencies and tribes to help reduce the impacts of prescribed fire programs on nearby communities. The forests work closely with adjacent landowners and communities, particularly their planning and zoning departments, to encourage new and existing developments to take into account measures to protect people, property, and natural resources from wildfire.

Related Plan Content for Community-Forest Intermix

See the following sections: All PNVTs, Scenic Byways, National Recreation Trails, Eligible and Suitable Wild and Scenic Rivers, Scenic Resources, Lands, Cultural Resources, American Indian Rights and Interests, and Wildland Fire Management.

High Use Developed Recreation Area

Background for High Use Developed Recreation Area

The High Use Developed Recreation Area Management Area includes places with relatively high levels of visitor use that are managed to provide a wide variety of opportunities to a broad spectrum of visitors. High use developed recreation areas contain one or more facilities and may accommodate large numbers of people. They are associated with, and often provide, access to popular destinations, transportation corridors, scenic byways, scenic vistas, lakes, and streams. Interaction among visitors is high. The High Use Developed Recreation Area Management Area includes the following recreation areas: Rim Lakes, Fool Hollow, Woodland Lake Park, Big Lake, Greer Lakes, and Luna Lake.

Desired Conditions for High Use Developed Recreation Area

- Facilities are well maintained and provide for accessibility, user safety, comfort, and convenience, as well as protection of resources.
- Visitors can expect to see a wide range of human activities and development (including roads, trails, interpretive sites, campgrounds, trailheads, fences, and day-use facilities).
- The evidence of management activities is common.
- The surrounding landscape is natural appearing, pastoral, or historic with variations created by the recreational facilities.
- Trails are well marked and may include features such as loop systems or interpretive information.
- Recreation opportunities range from semiprimitive motorized to rural.

Guidelines for High Use Developed Recreation Area

- Roads, facilities, and signing should be designed to blend with surroundings.
- Management should focus on operation and maintenance, safety, aesthetics, and control of noxious weeds and nonnative invasive species.

Management Approaches for High Use Developed Recreation Area

Recreation site plans describe the detailed management for each high use developed recreation area, including vegetation management plans for campgrounds. In addition to recreation use, other uses (including livestock grazing, timber management, and wildlife management) may occur in combination with surrounding recreation and scenic desired conditions.

Related Plan Content for High Use Developed Recreation Area

See the following sections: Developed Recreation, Scenic Resources, Scenic Byways, National Recreation Trails, and Eligible and Suitable Wild and Scenic Rivers.

Energy Corridor

Background for Energy Corridor

The Energy Corridor Management Area includes the three existing high voltage energy corridors located on the Apache-Sitgreaves NFs. Two corridors traverse the Sitgreaves NF: one containing 500 kV transmission lines and one containing 345 kV transmission lines. These are operated by Arizona Public Service and the Salt River Project. One 345 kV transmission line runs through a portion of the Clifton Ranger District; it is operated by Tucson Electric Power. Local distribution and low voltage transmission lines (up to 230 kV) are not included in this management area but are part of the management area in which they are physically located.

Although not mapped as a management area, there is one corridor that has been designated for future transmission facilities; it is located on the Sitgreaves NF and shares the same centerline as the existing 500 kV transmission line. It was set in place in January 2009 by the Secretary of Agriculture's Record of Decision for the "Designation of Section 368 Energy Corridors on National Forest System Land in 10 Western States." The corridor has a width of 3,500 feet and is multimodal. The existence of this corridor does not authorize any projects, nor does it mandate that future rights-of-way locate in the corridor, or preclude the Forest Service from denying a project or requiring design revisions. If transmission facilities or rights-of-way are authorized in this corridor, this plan would be amended to adjust the Energy Corridor Management Area.

Desired Conditions for Energy Corridor

- Energy corridors serve a public benefit by providing for a reliable supply of energy essential to local, regional, and national economies.
- Vegetative conditions and land uses within the energy corridor facilitate the operation and maintenance of the associated facilities and infrastructure.
- Vegetation consists predominantly of grasses, forbs, shrubs, low-growing trees, and sapling-sized trees.

Standards for Energy Corridor

- Obsolete or unused facilities within energy corridors shall be removed and the areas rehabilitated.

Guidelines for Energy Corridor

- Energy corridors should be managed as nonmotorized areas to avoid conflicts with corridor operations and maintenance needs, although operations and maintenance activities may use motorized equipment.

- To limit impacts to undisturbed areas, new utilities (e.g., power lines, telephone lines, gas lines) should be colocated within existing corridors whenever technically feasible, within existing rights-of-way (including road rights-of-way), or follow major transportation routes.
- Within and adjacent to energy corridors, vegetation should be managed similarly to the Community-Forest Intermix Management Area so that facilities stay operational and reduce the hazards of human-caused damage, damage from wildland fire, and falling trees.
- Clearing of vegetation along rights-of-way, facilities, and permitted sites should be limited to that which achieves desired conditions, abates an identified hazard to the facility, or for operational efficiency and weed control.
- Trees and shrubs in riparian areas should only be removed when there is an imminent threat to facilities and, in these cases, trees should be left for large coarse woody debris recruitment into the stream and riparian system.
- When planning and implementing vegetation treatments (e.g., corridor maintenance), vegetation within riparian zones that provides rooting strength important for bank stability should be encouraged.
- As utility facilities are maintained or replaced, relocation of corridors outside of riparian areas should be considered to reduce potential impacts to these ecologically sensitive areas.
- Invasive plant species should be aggressively controlled within energy corridors to prevent or minimize spread.

Management Approaches for Energy Corridor

Existing energy corridors are managed according to approved management plans. Energy utility companies also comply with maintenance standards enforced by the North American Electric Reliability Corporation. Energy corridors are generally not managed to provide recreation opportunities. They are managed for very low scenic integrity where vegetation and structural changes may attract attention and dominate the landscape when viewed from nearby.

Forest managers work toward establishing voluntary agreements with permit holders to reduce the effects of forest conditions and activities on the facilities. Future applicants are not precluded from proposing a project outside a designated energy corridor, though consideration and approval of such a request may require a plan amendment. Applicants would also need approval from the Arizona Corporation Commission.

Related Plan Content for Energy Corridor

See the following sections: Scenic Resources, Lands, Special Uses, National Recreation Trails, and Eligible and Suitable Wild and Scenic Rivers.

Wild Horse Territory

Background for Wild Horse Territory

This management area contains most of the Heber Wild Horse Territory, approximately 19,700 acres,[1] on the Black Mesa Ranger District. The territory was established in 1973 pursuant to the Wild Free-Roaming Horse and Burro Act of 1971 as amended with the purpose of providing use by and for the protection of wild horses. The Heber Wild Horse Territory is considered a special area by the Forest Service. The Forest Service entered into a Stipulation Agreement filed on March 2, 2007, agreeing that wild horses are by law an integral part and component of the natural system of the public lands, as expressed by Congress. Under the Stipulation Agreement, the Forest Service agreed to "refrain from any gathering or removing of horses within the Heber Wild Horse Territory, as well as, on the Black Mesa and Lakeside Ranger Districts (which are considered the Sitgreaves National Forest) until the Forest Service completes, with public involvement, an analysis and appropriate environmental document pursuant to NEPA and develops a written Heber Wild Horse Territory Management Strategy."

Desired Conditions for Wild Horse Territory

- Grazing is in balance with available forage (i.e., grazing and browsing by authorized livestock, wild horses, and wildlife do not exceed established use levels).
- Horse numbers within the territory are aligned with the appropriate management level[2] as described in the "Heber Wild Horse Territory Management Plan."
- The Wild Horse Territory Management Area contains landscapes that vary from moderately altered where human activities are evident (low scenic integrity) to natural appearing where human activities do not stand out (high scenic integrity).
- Recreation opportunities range from semiprimitive nonmotorized to roaded natural.

Guidelines for Wild Horse Territory

- When wild horse populations exceed the appropriate management level, horses should be removed in accordance with the "Heber Wild Horse Territory Management Plan" (when completed).

Management Approaches for Wild Horse Territory

The Forest Service will administer wild horses in the Heber Wild Horse Territory in accordance with applicable laws and regulations, including but not limited to 36 CFR Part 222, Subpart D. The Forest Service will work with the public to develop a Heber Wild Horse Territory Management Plan to direct specific management actions for the Heber Wild Horse Territory. Based on site-specific analysis, the management plan will determine an appropriate management

[1] Approximately 939 acres of the Heber Wild Horse Territory overlap the adjacent Community-Forest Intermix Management Area.

[2] The Interior Board of Land Appeals (IBLA) has defined the appropriate management level as the "optimum" number of wild horses (or burros) which results in a thriving natural ecological balance and avoids a deterioration of the range. (109 IBLA 119; also reference Dahl vs. Clark, supra at 592). It is usually expressed as a range of numbers. From http://www.blm.gov/nv/st/en/prog/wh_b/appropriate_management.html

level. As directed in the regulations at 36 CFR 222. 61(a)(1), the goal is to maintain a thriving ecological balance within the territory. Management actions may be needed both inside and outside of the territory to meet desired conditions.

Related Plan Content for Wild Horse Territory

See the following sections: Soils, All PNVTs, Riparian Areas, Forests: Ponderosa Pine, Forests: Dry Mixed Conifer, Wildlife and Rare Plants, Invasive Species, Developed Recreation, Livestock Grazing, and Community-Forest Intermix.

Wildlife Quiet Area

Background for Wildlife Quiet Area

Wildlife quiet areas (WQAs) were first identified in the 1980s by the Apache-Sitgreaves NFs in cooperation with the AZGFD to provide relatively undisturbed habitat where big game and other wildlife could reside without disturbance from motorized vehicle use. Other reasons they were set aside include the need to address road-related erosion, provide for more effective use of the habitat, and provide the nonmotorized hunter a high quality hunt opportunity without motorized impacts. These areas are recognized as key wildlife habitats. WQAs may also provide relatively undisturbed habitat and wildlife populations for research purposes.

Desired Conditions for Wildlife Quiet Area

- WQAs provide blocks of core habitat to meet wildlife life stage requirements during the breeding, rearing, and, in some cases, the critical wintering period.
- WQAs contribute to preserving natural behaviors and processes that sustain wildlife populations associated with each WQA (see below).
- WQAs provide for wide ranging predators and big game species, are large enough for a range of species, and provide for population and genetic exchange.
- WQAs lack disturbance from motorized vehicles, resulting in less stress to wildlife.
- WQAs provide undisturbed, nonmotorized hunting opportunities.
- WQAs provide semiprimitive nonmotorized recreation opportunities, including relatively quiet recreation opportunities close to or adjacent to intensively used areas.
- Landscapes in WQAs vary from slightly altered where human activities may be seen but do not attract attention (moderate scenic integrity) to natural appearing where human activities do not stand out (high scenic integrity).
- Willow Springs Horse Trap and Beaver-Turkey Ridge WQAs provide quiet areas for big game amid the intensive recreation uses on the Black Mesa Ranger District.
- Bear Springs and Cottonwood Seep WQAs provide quality travel, hiding, and thermal cover along the Mogollon Rim (Black Mesa and Lakeside Ranger Districts) for a wide variety of species ranging from turkeys to mountain lions. The WQAs provide an abundance of browse species important for deer and elk.

- Woolhouse WQA on the Lakeside Ranger District provides high quality winter range for pronghorn antelope and elk within a busy and heavily used wildland-urban interface.
- The Hulsey Bench WQA on the Alpine Ranger District provides Mexican spotted owl, northern goshawk, elk, deer, turkey, and bear refuge habitat.
- The Open Draw WQA on the Alpine Ranger District provides high quality foraging and young rearing habitat for deer, elk, turkey, and bear.
- Middle Mountain WQA provides refuge for northern goshawk, turkey, deer, elk, and Mexican spotted owl amid extensive dispersed recreation on the Alpine Ranger District.
- Upper Coyote Creek WQA on the Alpine Ranger District provides high quality habitat, especially undisturbed young rearing habitat, for deer, elk, turkey, and bear.
- St. Peters Dome WQA on the Springerville Ranger District provides high quality spruce-fir habitat for dusky grouse, bear, and other high elevation species.

Guidelines for Wildlife Quiet Area

- All WQAs should be managed to preclude snowmobile use to minimize disturbance during the critical winter period.
- WQA boundaries should be signed to identify the areas and educate the public about their purpose.
- Fences surrounding and within WQAs should be inspected and improved to allow wildlife movement within and outside of the areas. Fences should be removed if no longer needed.
- Hiding cover and travel ways for wildlife should be maintained to provide for security and connectivity of habitat.
- Restoration treatments should consider the needs of wildlife (e.g., calving/fawning areas, wallows, game crossings) to minimize potential impacts to the species and their habitat.

Management Approaches for Wildlife Quiet Area

WQAs are similar to the General Forest Management Area, but they are managed for nonmotorized access (except when otherwise authorized). There is an emphasis on improving wildlife habitat and maintaining existing wildlife developments. Management of habitat within WQAs may provide a benchmark for assessing effects of activities on generally undisturbed wildlife populations. The road in the Open Draw WQA is managed as open on a seasonal basis.

Related Plan Content for Wildlife Quiet Area

See the following sections: Overall Ecosystem Health, Wildlife and Rare Plants, Scenic Resources, National Recreation Trails, and Eligible and Suitable Wild and Scenic Rivers.

Natural Landscape

Background for Natural Landscape

These are generally undeveloped areas that are natural appearing and provide primitive and semiprimitive recreation opportunities. Management activities are allowed but are primarily focused on ecosystem restoration. This management area includes most of the inventoried roadless areas (IRAs) that were identified in the 2001 Roadless Area Conservation Rule. IRAs are managed to protect and conserve their roadless character.

Desired Conditions for Natural Landscape

- Succession, fire, insects, disease, floods, and other natural processes and disturbance events primarily shape the composition, structure, and landscape patterns of the vegetation (although management activities may also have a minor influence).
- These areas contribute to ecosystem and species diversity and sustainability; serve as habitat for plants and animals; and offer wildlife corridors, reference areas, primitive and semiprimitive nonmotorized recreation opportunities, and places for people seeking natural scenery and solitude.
- Inventoried roadless areas (IRAs) maintain their overall roadless character.
- Roads and human structures may be present, although uncommon.
- Landscapes vary from natural appearing where human activities do not stand out (high scenic integrity) to natural where generally only ecological changes occur (very high scenic integrity), except as described below.
- Developed campgrounds, picnic areas, trailheads, and roads passable by passenger cars provide roaded natural recreation opportunities. Landscapes within and immediately adjacent to these features remain scenic. They may be slightly altered where human activities may be seen but do not attract attention (moderate scenic integrity) to natural appearing where human activities do not stand out (high scenic integrity).
- While emphasizing semiprimitive nonmotorized and primitive recreation opportunities, motorized travel may occur on designated NFS roads and motorized trails.
- Natural landscapes contribute to preserving natural behaviors and processes that sustain wildlife populations.

Standards for Natural Landscape

- New mineral material pits shall not be authorized.

Guidelines for Natural Landscape

- Limited cross-country motorized vehicle use may be authorized for administrative purposes.
- Temporary road construction and motorized equipment may be used in order to achieve ecological desired conditions.

- NFS roads should be maintained to the minimum standard to meet the objective maintenance level.
- Unneeded mineral material pits should be closed, recontoured, and revegetated.

Management Approaches for Natural Landscape

The management emphasis is to retain the natural appearing character of these areas. Management activities occur mostly for ecological restoration because of natural ecological events or previous management actions. Management activities may include restoration of ecological conditions or habitat components, soil stabilization, wildland fire, hazardous fuels reduction, and invasive species reduction. Livestock grazing may occur where appropriate.

Related Plan Content for Natural Landscape

See the following sections: Scenic Byways, National Recreation Trails, Eligible and Suitable Wild and Scenic Rivers, Scenic Resources, and Wildland Fire Management.

Research Natural Area

Background for Research Natural Area

RNAs are physical or biological units in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural physical and biological processes to prevail without human intervention. However, under unusual circumstances, deliberate manipulation may be utilized to maintain the unique feature that the RNA was established to protect. (Forest Service Manual 4063.05)

Research natural areas (RNAs) are considered special areas by the Forest Service. RNAs are part of a national network of natural areas designated in perpetuity for research and education and/or to maintain biological diversity on NFS lands. RNAs are principally for non-manipulative research, observation, and study. However, RNAs can be used for manipulative research to help quantify and understand ecosystem processes and to improve forest management practices.

This management area contains two special areas—the Phelps Cabin Research Natural Area and Phelps Cabin Botanical Area. The botanical area is recommended to be incorporated into the Phelps Cabin RNA. See the “Recommended Research Natural Area” section for more information.

The Phelps Cabin RNA is located on the Springerville Ranger District and is approximately 290 acres[3]. It was established in 1970 to protect its natural condition and provide scientific study and education and for the maintenance of biological diversity. Located at approximately 9,400 feet in elevation, a portion of the RNA lies within Mount Baldy Wilderness. The overall terrain is gently rolling. Wetland communities contain several plant species of special interest including the Arizona willow and Mogollon paintbrush. Mixed conifer forest with spruce, fir, and aspen are present on uplands adjacent to the wet meadows.

[3] A portion of the Phelps Cabin RNA falls within the Wilderness Management Area.

Desired Conditions for Research Natural Area

- The Phelps Cabin RNA provides opportunities for research, study, observation, monitoring, and educational activities that maintain the natural conditions for which the area was established.
- The Phelps Cabin RNA, outside of Mount Baldy Wilderness, exhibits landscapes that vary from natural appearing where human activities do not stand out (high scenic integrity) to natural where generally only ecological changes occur (very high scenic integrity).
- Recreation opportunities, although not encouraged, are semiprimitive nonmotorized.

Standards for Research Natural Area

- The Phelps Cabin RNA will be surveyed and posted with boundary signs within the planning period.
- The Phelps Cabin RNA will be managed for nonmotorized access within the area; exceptions may be made for permitted research use.

Guidelines for Research Natural Area

- Management measures should be used (e.g., fencing) to protect unique features.
- To minimize impacts to unique and sensitive plant species, recreational activities (other than use on the designated trail) should not be encouraged.
- Research special use authorizations should limit impacts to sensitive resources, unique features, and species within the RNA.

Related Plan Content for Research Natural Area

See the following sections: Eligible and Suitable Wild and Scenic Rivers, Scenic Resources, and Special Uses.

Recommended Research Natural Area

Background for Recommended Research Natural Area

Research natural areas are considered special areas by the Forest Service. There is a regional need for research natural areas that fall into specific categories (e.g., piñon-juniper, ponderosa pine, semi-desert grassland, wetland/cienega riparian area, and montane willow and cottonwood-willow riparian forested PNVTs; quaking aspen; other aquatic habitats). The Apache-Sitgreaves NFs have the opportunity to contribute to these needs.

There are six recommended RNAs: Thomas Creek, Corduroy, Three Forks, Lower Campbell Blue, Sandrock, and the recommended Phelps Cabin RNA addition (Phelps Cabin Botanical Area). The first four recommended RNAs are located on the Alpine Ranger District. The Sandrock RNA is located on the Clifton Ranger District. The Phelps Cabin RNA addition is located on the Springerville Ranger District.

The recommended Thomas Creek RNA is approximately 550 acres. It provides a representation of the wet mixed conifer and spruce-fir PNVTs and can serve as a reference for the study of succession and as a baseline for measuring long term change. The area may also serve as a baseline for evaluating the effects of fire and silvicultural prescriptions for timber and water production. It can also serve as an area to study the effects of climate change since the spruce-fir PNVT is sensitive to changes in temperature and moisture.

The recommended Corduroy RNA is approximately 3,350 acres. It provides a representation of high elevation vegetation types including aspen. This area may help researchers and foresters learn more about the multiple causes of sudden aspen decline (SAD), which is widespread across the Apache-Sitgreaves NFs and other Arizona national forests. SAD results in the death of aspen root systems, thus causing total loss of aspen clones from affected sites.

The recommended Three Forks RNA is approximately 2,900 acres. This area provides a representation of montane willow riparian forested PNVT, fens, and wetlands unique to the Apache-Sitgreaves NFs. It also provides habitat for several rare aquatic species: California floater, Three Forks springsnail, loach minnow, and Chiricahua leopard frog. This area provides research opportunities and serves as a reference for studying effects of fire, climate change, and management activities. It may also serve as a research area for control of invasive species while maintaining native species.

The recommended Lower Campbell Blue RNA is approximately 580 acres. This area is a prime example of high quality riparian vegetation and old growth forests. It provides habitat for Chiricahua leopard frog, loach minnow, New Mexico meadow jumping mouse, and Mexican spotted owl. This area may serve as a reference for studying grazing impacts in riparian areas and climate change.

The recommended Sandrock RNA is approximately 530 acres. It represents the semi-desert grassland PNVT containing a variety of native grasses and forbs. This area has been excluded from domestic grazing for 25 years and provides a reference for studying past and future grazing effects.

It is recommended that the Phelps Cabin Botanical Area be incorporated into the Phelps Cabin RNA (see the “Research Natural Area” section for more information). The Phelps Cabin Botanical Area, approximately 100 acres, is the only botanical area on the Apache-Sitgreaves NFs. It has been under special management for botanical and research values since 1910. It is located on the Springerville Ranger District along the East Fork Little Colorado River, adjacent to Phelps Cabin RNA and outside Mount Baldy Wilderness. Upon RNA designation, the botanical area designation would be removed.

Upon approval of the plan, the forests will recommend these RNAs to the Southwestern Region RNA Committee. If an RNA is recommended by the regional committee, it must undergo an ecological evaluation and a NEPA environmental assessment. To proceed with formal RNA designation, the committee must recommend the area to the Southwestern Regional Forester and Rocky Mountain Research Station Director for approval.

Desired Conditions for Recommended Research Natural Area

- The recommended RNAs provide opportunities for research, study, observation, monitoring, and educational activities that maintain the natural conditions for which the area was recommended.
- The Three Forks Closure Area (30 acres) of the recommended Three Forks RNA is free from human trampling and other disturbances to protect very sensitive and unique species, such as the Three Forks springsnail, California floater, New Mexico meadow jumping mouse, Chiricahua leopard frog, and loach minnow.
- The recommended Three Forks, Campbell Blue, Corduroy, and Sandrock RNAs, outside of any eligible or suitable wild and scenic river corridor, exhibit unaltered appearing landscapes where human activities do not stand out (high scenic integrity).
- The recommended Thomas Creek RNA exhibits slightly altered landscapes where human activities may be seen but do not attract attention (moderate scenic integrity).
- The recommended Phelps Cabin RNA addition (currently the Phelps Cabin Botanical Area), outside of any eligible or suitable wild and scenic river corridor, exhibits unaltered appearing landscapes where human activities do not stand out (high scenic integrity).
- Natural conditions prevail in the recommended Phelps Cabin RNA addition while providing an opportunity for interpretation, education, and research.
- Unique plant species, including willows, paintbrushes, and gentians, thrive in the recommended Phelps Cabin RNA addition.

Guidelines for Recommended Research Natural Area

- To minimize impacts to unique and sensitive plant and animal species, recreational activities should not be encouraged.
- If necessary, recommended RNAs should be fenced to manage unique features.
- Research special use authorizations should limit impacts to sensitive resources, unique features, and species within recommended RNAs.
- Recommended RNAs should be managed for nonmotorized access within the area to minimize ground disturbances and protect the resources which make these areas unique.

Management Approaches for Recommended Research Natural Area

If a recommended RNA is not designated within 5 years of this plan’s approval, an evaluation may be conducted to verify the continued need as a research natural area. If there is none, a plan amendment may be completed to return the land area to other management. Lands returning to other management are evaluated for suitability (chapter 4) for appropriate uses.

Related Plan Content for Recommended Research Natural Area

See the following sections: Eligible and Suitable Wild and Scenic Rivers, Scenic Resources, and Special Uses.

Wilderness

Background for Wilderness

The Apache-Sitgreaves NFs are home to three designated wilderness areas: Mount Baldy Wilderness, located on the Springerville Ranger District, and Escudilla and Bear Wallow Wilderness areas, located on the Alpine Ranger District. Wilderness areas are managed and their values protected according to the Wilderness Act of 1964 (Public Law 88-577). Wilderness areas provide opportunities for solitude or a primitive and unconfined type of recreation. Motorized equipment and mechanical transport is prohibited in wilderness. Livestock grazing is allowed in wilderness unless specifically excluded by the law designating the area. Grazing is not restricted in any of the Apache-Sitgreaves NFs wilderness areas.

Mount Baldy Wilderness was designated as part of the National Wilderness Preservation System in 1970 (Public Law 91-504). Its approximate 7,000 acres lie on the eastern slope of Mount Baldy. Elevations range from 9,000 to 11,400 feet above sea level. Mount Baldy is an extinct volcano which has experienced three distinct periods of glaciation. The peak's summit is on the Fort Apache Indian Reservation. Three developed trails traverse this wilderness. The East and West Forks of the Little Colorado River are perennial through this wilderness and provide habitat for the threatened Apache trout.

Escudilla Wilderness, approximately 5,200 acres, was designated in 1984 (Public Law 98-406). This area encompasses the top and sides of Escudilla Mountain. It is home to several high elevation meadows which include some relatively rare plant associations. Notable landmarks in or just outside the wilderness include Profanity Ridge, Terry Flat, Toolbox Draw, and the Punchbowl. The Escudilla National Recreation Trail leads to the top of Escudilla Mountain.

Figure 11. East Fork of the Little Colorado River in Mount Baldy Wilderness

Bear Wallow Wilderness, approximately 11,080 acres, was designated in 1984 (Public Law 98-406). This area is known for its canyon, large old conifers, and fall aspen colors. Several trails provide access into and through this area. Bear Wallow Creek flows throughout the year, providing habitat for the threatened Apache trout. Wildlife is abundant throughout the area.

Desired Conditions for Wilderness

- Ecological conditions are affected primarily by natural ecological processes, with the appearance of little or no human intervention.
- Fire functions as a natural ecological process.
- There is little evidence of human developments and little or no evidence of camping activity, unauthorized trails, trash, or other human impacts on the environment.
- Visitor use does not affect wilderness characteristics.
- Wilderness boundaries are posted and visible to visitors.
- There are unconfined opportunities for exploration, solitude, risk, and challenge. The nonmotorized trail system enhances the wilderness character. Where there is public demand, outfitters and guides provide services to visitors seeking a wilderness experience.
- Bear Wallow Wilderness provides outstanding opportunities for solitude and isolation. Encounters with small groups or individuals are infrequent.
- Within Mount Baldy and Escudilla Wilderness areas, trails concentrate use and provide access to popular destinations. Encounters with other users may occur.
- Wilderness areas maintain natural landscapes where generally only ecological changes occur (very high scenic integrity) and provide primitive and/or semiprimitive nonmotorized recreation opportunities.
- Wilderness contributes to preserving natural behaviors and processes that sustain wildlife populations.

Standards for Wilderness

- Party size of 12 persons and/or 12 head of stock for hiking and riding groups in Mount Baldy Wilderness shall not be exceeded. A party size of 6 persons for overnight camping shall not be exceeded.
- Party size of 12 persons and/or 15 head of stock for hiking and riding groups in Escudilla and Bear Wallow Wilderness and the Blue Range Primitive Area shall not be exceeded.
- Objective(s) and strategies for all wildfires shall be identified.
- Fire management activities shall be conducted in a manner compatible with the overall wilderness management objectives (minimum impact suppression tactics).
- Human-caused disturbed areas that do not complement wilderness characteristics will be rehabilitated to a natural appearance, using species or other materials native to the area.

Guidelines for Wilderness

- New trail construction may be considered if the objective is enhancement of the wilderness character (e.g., increase solitude opportunities, restore naturalness).

- Trail maintenance should be coordinated around anticipated visitor high use periods to minimize encounters.
- Trails that have minimal use, detract from the wilderness character, or cannot practically be maintained or reconstructed should be obliterated.
- Prescribed fire should be considered to reduce the risks and consequences of uncharacteristic wildfire within wilderness or escaping from wilderness by reducing unnatural fuel accumulations, if necessary to meet wilderness fire management objectives. Naturally occurring wildfires should be allowed to perform, as much as possible, their natural ecological role within wilderness.
- Fire camps, helispots, and other temporary facilities should be located outside the wilderness boundary to protect wilderness character.
- Firelines and spike camps (i.e., a remote camp usually near a fireline) should not be constructed adjacent to trails or camp areas to protect wilderness values.
- Grazing of pack stock should not occur except as authorized by the district ranger when adequate forage is available.

Management Approaches for Wilderness

There is a need to complete and implement wilderness management plans, wilderness use capacity studies, and comprehensive vegetation inventories for each designated wilderness. The Congressional Grazing Guidelines (FSM 2320 – Wilderness Management, section 2323.33 – Exhibit 01) are used to manage livestock grazing in wilderness areas. The “Minimum Requirements Decision Guide” is used to assess actions proposed within wilderness. Priorities for trail reconstruction are based on potential for loss of wilderness values, impacts to wilderness recreation opportunities, and the trails which receive the greatest use.

Related Plan Content for Wilderness

See the following sections: Air, Invasive Species, Overall Recreation Opportunities, Eligible and Suitable Wild and Scenic Rivers, Scenic Resources, and Wildland Fire Management.

Primitive Area

Background for Primitive Area

The primitive area is considered a special area by the Forest Service. This management area consists of the Blue Range Primitive Area along with the presidential recommended additions to the area (199,502 acres). The only remaining primitive area in the National Forest System, the Blue Range Primitive Area is located on the Alpine and Clifton Ranger Districts. It was administratively designated by the Forest Service (L-20 regulations[4]) as a primitive area on June 21, 1933, to preserve its wilderness qualities. The Blue Range Primitive Area is managed as wilderness, with one exception: the area is open to mineral prospecting and mineral development.

[4] In 1939, the Secretary of Agriculture issued Regulations U-1, U-2, and U-2A (collectively, the "U-Regulations") to replace the L-20 Regulation.

The Blue Range Primitive Area's approximate 180,000 acres include deep, rugged canyons separated by steep, timbered ridges. The Mogollon Rim bisects the area and provides dramatic topographic features. Elevations range from 4,500 feet in the southern portion to 9,100 feet along the rim. This rapid change in elevation results in interesting and unique ecological associations. Unusual and spectacular rock formations highlight the scenery.

The Blue Range Primitive Area is important in the distribution of wildlife species. It lies on both north-south and east-west migration corridors. The wide variety of vegetation types reflects the area's topography. There are approximately 270 miles of nonmotorized trails throughout the primitive area, about one quarter of the forests' trails.

In 1971, the Forest Service submitted a recommendation to the President of the United States for the Blue Range Wilderness in New Mexico and Arizona. The President forwarded the recommendation to Congress, who eventually acted on a portion of the recommendation. In 1980 Congress designated, and the President signed into law, the Blue Range Wilderness in New Mexico. The Arizona portion of the 1971 presidential recommendation (166,591 acres) included 20,031 acres outside and along the west primitive area boundary. The Forest Service and presidential recommendation for the Blue Range Wilderness in Arizona has not been acted upon.

The entire Blue Range Primitive Area and the presidential recommended additions have been managed to protect their wilderness characteristics.

Desired Conditions for Primitive Area

All wilderness desired conditions apply to the entire Blue Range Primitive Area and presidential recommended additions until congressional action has been taken.

- The Blue Range Primitive Area and presidential recommended additions maintain natural landscapes where generally only ecological changes occur (very high scenic integrity) and provide primitive recreation opportunities, except along the designated road (36 CFR § 293.17(a)).

Standards and Guidelines for Primitive Area

All wilderness standards and guidelines apply to the entire Blue Range Primitive Area and presidential recommended additions until congressional action has been taken.

Management Approaches for Primitive Area

The Apache-Sitgreaves NFs continue to manage the Blue Range Primitive Area and the presidential recommended additions as a primitive area until Congress acts on the 1971 wilderness recommendation. Should Congress not designate any portion of this management area as wilderness and release lands from primitive area status, the released lands would be managed as a part of the Natural Landscape Management Area.

A management plan for the area, including comprehensive vegetation inventory, is needed to provide more detailed management guidance. The Congressional Grazing Guidelines (FSM 2320 – Wilderness Management, section 2323.33 – Exhibit 01) are used to manage livestock grazing in

the primitive area. The "Minimum Requirements Decision Guide" is used to assess actions proposed within the primitive area.

Related Plan Content for Primitive Area

See the following sections: Invasive Species, Overall Recreation Opportunities, Eligible and Suitable Wild and Scenic Rivers, Scenic Resources, and Wildland Fire Management.

Recommended Wilderness

Background for Recommended Wilderness

In 2009, Apache-Sitgreaves National Forest System lands were evaluated to determine potential wilderness areas. Table 5 below identifies the areas recommended for wilderness. There are no Forest Service system trails in these areas.

Table 5. Areas recommended for wilderness

Name	Acreage
Escudilla Wilderness Addition	6,813
Bear Wallow Wilderness Additions	261
Total	**7,074**

These are preliminary administrative recommendations that will receive further review, including the applicable NEPA analyses, and possible modification by the Chief of the Forest Service, Secretary of Agriculture, and President of the United States. Congress has reserved the authority to make final decisions on wilderness designation.

Desired Conditions for Recommended Wilderness

- Recommended wilderness areas display natural landscapes where generally only ecological changes occur (very high scenic integrity) and provide primitive or semiprimitive nonmotorized recreation opportunities.
- Recommended wilderness contributes to preserving natural behaviors and processes that sustain wildlife populations.

Standards for Recommended Wilderness

- Objective(s) and strategies for all wildfires shall be identified.
- Fire management activities shall be conducted in a manner compatible with maintaining wilderness characteristics (minimum impact suppression tactics).
- Human-caused disturbed areas that do not complement wilderness characteristics shall be rehabilitated to a natural appearance, using plant species or other materials native to the area.

Guidelines for Recommended Wilderness

- The wilderness characteristics of each recommended wilderness should remain intact until a congressional decision on wilderness designation is made. Characteristics include naturalness, opportunities for solitude, opportunities for primitive recreation, and identified special features.
- Only nonmotorized travel may occur in recommended wilderness. However, motorized use associated with grazing allotments may occur and should be limited to that needed to carry out required management practices as authorized.
- Prescribed fire should be considered to reduce the risks and consequences of uncharacteristic wildfire by reducing unnatural fuel accumulations, if necessary to meet fire management objectives. Naturally occurring fires should be allowed to perform, as much as possible, their natural ecological role.
- Fire camps, helispots, and other temporary facilities should be located outside the recommended wilderness to protect wilderness values.

Related Plan Content for Recommended Wilderness

See the following sections: Overall Recreation Opportunities, Eligible and Suitable Wild and Scenic Rivers, Scenic Resources, and Wildland Fire Management.

Chapter 4. Suitability

Introduction to Suitability

The Apache-Sitgreaves NFs are suitable, or appropriate, for a variety of uses. The broad use categories on the following pages are not intended to be all inclusive. Other uses, projects, or activities may be proposed during the life of the plan. Acquired lands are evaluated for suitability (chapter 4) prior to being allocated to appropriate uses.

An identification of an area as suitable for a particular use does not mean that the use will occur over the entire area. Likewise, identifying that a particular use is not suitable in a management area does not mean that the use will not occur in specific areas. The identification of an area as suitable for various uses is guidance for project and activity decision-making and is not a resource commitment or final decision approving projects and activities. Final decisions on resource commitments are made at the project level. The final decision to authorize livestock grazing would be made at a project (allotment) level.

Forestwide suitability calculations (acres suitable versus not suitable) can be found in appendix B of the Apache-Sitgreaves NFs "Programmatic Environmental Impact Statement for the Land Management Plan" (Forest Service, 2012a). Specifics about suitability of areas are analyzed at the project or activity level and are subject to laws, regulations, and plan guidance. Areas that are not suitable are those where a use is not compatible with desired conditions. However, this does not mean that the use cannot occur. Conversely, areas identified as suitable, when analyzed at the project or activity level, may not be able to support that use[1].

The suitability determinations (plan decisions) are summarized below and displayed in tables 6 through 11. The information outside of these tables is not a plan decision but is provided for background. Plan decisions and other content for forestwide direction (chapter 2) and management areas (chapter 3) should also be consulted.

Livestock Grazing Suitability

Livestock grazing is defined as foraging by permitted livestock, including cattle, horses, and sheep. Provisions of the 1982 Planning Rule require that the capability and suitability for producing forage for grazing animals on National Forest System (NFS) lands be determined.

Capability is the potential of an area of land to produce resources and supply goods and services. Capability depends upon current conditions and site conditions such as climate variability, slope, landform, soils, and geology. Although capability was determined in the 1980s during the first round of forest planning, it was necessary to recreate that determination because the original records were not retained. This process is documented in the planning record (Nelson, 2016).

Suitability is the appropriateness of applying certain resource management practices to a particular area of land, in consideration of relevant social, economic, and ecological factors. Suitable rangeland is determined based on compatibility with desired conditions and objectives in the plan area. Lands within the plan area are not identified as suitable for a certain use if that use is prohibited by law, regulation, or policy; would result in substantial and permanent impairment of the productivity of the land or renewable resources; or if the use is incompatible with the desired conditions for the relevant portion of the plan area. A unit of land may be suitable for a variety of individual or combined management practices. Table 6 identifies areas as suitable or not suitable for livestock grazing.

[1] As a result of site-specific analysis if plan suitability needs adjustment, it can be accomplished through a plan amendment.

Table 6. Suitability of livestock grazing on the Apache-Sitgreaves NFs

Management Area	Livestock Grazing Suitable	Livestock Grazing Not Suitable[a]
General Forest	X	
Community-Forest Intermix	X	
High Use Developed Recreation Area	X	
Energy Corridor	X	
Wild Horse Territory	X	
Wildlife Quiet Area	X	
Natural Landscape	X	
Recommended Research Natural Area		X
Research Natural Area		X
Primitive Area	X	
Recommended Wilderness	X	
Wilderness	X	
Other Areas		
Active and vacant grazing allotments	X	
Current National Forest System land not in a grazing allotment		X

[a] Areas that are not suitable for livestock grazing may occur within allotment boundaries but do not contribute to the overall grazing capacity of the allotment.

Special Uses Suitability

Table 7 identifies select special use categories that are suitable or not suitable on certain areas of the Apache-Sitgreaves NFs. Energy corridors are linear strips of land identified for the present or future location of a utility right-of-way (e.g., above or below-ground electric transmission line, gas pipeline). Other energy developments include the infrastructure associated with the provision or transport of energy (e.g., dam, biomass power generation, wind turbines, solar panels). Communications sites are National Forest System lands used for telecommunications services as identified in appendix C.

Table 7. Suitability of select special uses on the Apache-Sitgreaves NFs

Management Area	Energy Corridor Suitable	Energy Corridor Not Suitable	Other Energy Development Suitable	Other Energy Development Not Suitable	Communications Site Suitable	Communications Site Not Suitable
General Forest	X		X		X	
Community-Forest Intermix	X		X		X	
High Use Developed Recreation Area		X		X	X	

Management Area	Energy Corridor Suitable	Energy Corridor Not Suitable	Other Energy Develop-ment Suitable	Other Energy Develop-ment Not Suitable	Communi-cations Site Suitable	Communi-cations Site Not Suitable
Energy Corridor	X		X		X	
Wild Horse Territory	X		X		X	
Wildlife Quiet Area		X[a]		X		X
Natural Landscape		X		X		X
Recommended Research Natural Area		X		X		X
Research Natural Area		X		X		X
Primitive Area		X		X		X
Recommended Wilderness		X		X		X
Wilderness		X		X		X
Other Areas						
Areas with natural appearing landscapes where human activities do not stand out (high scenic integrity) or natural landscapes where generally only ecological changes occur (very high scenic integrity)		X		X		X
Eligible or suitable wild and scenic river corridors		X		X		X
Sacred sites or American Indian traditional cultural properties		X		X		X

[a] Existing energy corridors that cross wildlife quiet areas are considered suitable.

Lands Suitable for Timber Production

The National Forest Management Act requires that NFS lands be classified as to their suitability for timber production. NFS lands were reserved with the intent of providing goods and services to satisfy public needs over the long term, among these goods is the production of a sustainable supply of forest products. Therefore, some level of regulated forest production is necessary and appropriate from forested lands.

Timber production is the purposeful growing, tending, harvesting, and regeneration of regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. The term “timber production” does not include the production of firewood. On those lands classified as suitable for timber production (also referred to as suitable timberlands), the objective is to manage toward desired conditions, including restoring natural fire regimes, on a planned and regulated basis. Timber production activities contribute to a viable wood products processing industry.

In 2014, of the more than 2 million acres of NFS land, there are approximately 596,700 acres of NFS land that are suitable for timber production and 1,418,600 acres that are not suitable.

Tree cutting is a broad term which describes the cutting of trees for uses such as safety, firewood, biomass, and small wood products. Materials from these cuts may be made available for sale. Tree cutting may be used to move toward the vegetation desired condition, but a planned and periodic harvest of forest products may be unfeasible and/or regeneration of the stand is not anticipated. For example, many grasslands on the Apache-Sitgreaves NFs are encroached by woody species. Cutting trees would help restore these grasslands.

Table 8 identifies areas of the Apache-Sitgreaves NFs that are suitable or not suitable for timber production and tree cutting.

Table 8. Suitability of lands for timber production and tree cutting

Management Area	Timber Production Suitable	Timber Production Not Suitable	Tree Cutting Suitable	Tree Cutting Not Suitable
General Forest	X		X	
Community-Forest Intermix	X		X	
High Use Developed Recreation Area		X	X	
Energy Corridor		X	X	
Wild Horse Territory	X		X	
Wildlife Quiet Area	X		X	
Natural Landscape		X	X	
Recommended Research Natural Area		X		X[b]
Research Natural Area		X		X[b]
Primitive Area		X		X[c]
Recommended Wilderness		X		X
Wilderness		X		X[c]
Areas with soil condition rating of unsuited/inherently unstable		X		X
Other Areas				
Lands not cost efficient in meeting timber production objectives		X	X	
Grasslands, woodlands, interior chaparral, and riparian forested PNVTs		X	X	
Communications sites		X	X	
Developed recreation and administrative sites		X	X	
Eligible or suitable wild and scenic river corridors		X	X[d]	
MSO protected activity centers		X	X	

[a] Suitability refers to areas that are accessible and operable for cutting with motorized or nonmotorized equipment. Most areas are suitable for nonmotorized (e.g., handsaw, axe) tree cutting.

[b] Tree cutting for research purposes is allowed.

[c] Trees may be cut in the Primitive Area or Wilderness Management Areas with nonmotorized equipment (e.g., axe, bucksaw) and primarily for trail maintenance (FSM 2323.13f, 2323.53, 2326).

[d] Tree cutting is not suitable in segments classified as wild except where needed in association with a primitive recreation experience such as to clear trails (FSH 1909.12 Chapter 82.51).

Motorized Uses Suitability

This section describes the suitability of areas for motorized uses, including motorized travel and new designated motorized areas, roads, trails, or temporary roads intended for motorized vehicles.

Table 9 below displays areas that are suitable and not suitable for motorized travel. **Motorized travel** is defined as movement using machines that use a motor, engine, or other nonliving power sources other than a vehicle operated on rails or a wheelchair or mobility device, including one that is battery powered, that is designed solely for the use by a mobility impaired person for locomotion and that is suitable for use in an indoor pedestrian area.

Figure 12. A forest user rides along the Saffel Canyon OHV Trail

This plan provides the framework to guide future changes to the transportation system. Once the final decision of this plan has been made, potential changes to the forests' transportation system will be evaluated under this framework and through implementation of the Travel Management Rule (36 CFR § 212). Upon completion of travel management planning, the associated motor vehicle use map (MVUM) would be printed. The MVUM would display the roads, trails, and areas that are designated for motorized vehicle use. Travel management planning is not a static process. Based on public input, monitoring, and site-specific analysis, the MVUM could be adjusted. The annual reissuing of the MVUM would reflect any changes made through the NEPA process. Use inconsistent with those designations, and inconsistent with this plan, would be prohibited.

Table 9. Suitability of motorized travel on the Apache-Sitgreaves NFs

Area	Motorized Travel Suitable	Motorized Travel Not Suitable
On NFS roads, NFS motorized trails, or designated motorized areas	X	
Off of NFS roads, NFS motorized trails, or designated motorized areas (unless exempted[a])		X

[a] Per the Travel Management Rule (36 CFR § 212 Subpart B), the following vehicles and uses are exempted: (a) aircraft; (b) watercraft; (c) over-snow vehicles[2]; (d) limited administrative use by the Forest Service; (e) use of any fire,

[2] Use by over-snow vehicles is governed by Subpart C of the Travel Management Rule, which states that "use by over-snow vehicles on National Forest System roads and National Forest System trails and in areas on National Forest lands may be allowed, restricted,

military, emergency, or law enforcement vehicle for emergency purposes; (f) authorized use of any combat or combat support vehicle for national defense purposes; (g) law enforcement response to violations of law, including pursuit; (h) motor vehicle use that is specifically authorized under a written authorization issued under Federal law or regulations; and (i) use of a road or trail that is authorized by a legally documented right-of-way held by a State, county, or other local public road authority.

Table 10 displays areas that are suitable and not suitable for future consideration of a new designated motorized area, NFS road, NFS motorized trail, or temporary road construction. A **designated motorized area** is one that has been designated for motor vehicle use. **NFS roads and motorized trails** are roads and motorized trails that the Forest Service determines are necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources. **NFS motorized trails** are divided into two categories—greater than 50 inches and less than 50 inches—to accommodate a variety of vehicles. **Temporary roads** are roads necessary for emergency operations or are authorized by contract, permit, lease, or other written authorization; they are not a NFS road or trail and not included in a forest transportation atlas. Temporary roads are removed or rehabilitated following completion of the activity for which they were built.

Table 10. Suitability for new designated motorized areas, NFS roads, NFS motorized trails, and temporary road construction on the Apache-Sitgreaves NFs

Management Area	New Designated Motorized Area		NFS Road and NFS Motorized Trail > 50"		NFS Motorized Trail < 50"		Temporary Road	
	Suitable	Not Suitable	Suitable	Not Suitable	Suitable	Not Suitable	Suitable	Not Suitable
General Forest	X		X		X		X	
Community-Forest Intermix	X		X		X		X	
High Use Developed Recreation Area		X	X		X		X	
Energy Corridor		X	X			X	X	
Wild Horse Territory	X		X		X		X	
Wildlife Quiet Area		X		X		X	X	
Natural Landscape		X		X		X	X	
Recommended Research Natural Area		X		X		X		X
Research Natural		X		X		X		X

or prohibited.

Management Area	New Designated Motorized Area		NFS Road and NFS Motorized Trail > 50"		NFS Motorized Trail < 50"		Temporary Road	
	Suitable	Not Suitable	Suitable	Not Suitable	Suitable	Not Suitable	Suitable	Not Suitable
Area								
Primitive Area		X		X		X		X
Recommended Wilderness		X		X		X		X
Wilderness		X		X		X		X
Other Areas								
Meadows, wetlands, riparian areas, and along stream bottoms		X		X		X		X
Eligible or suitable wild and scenic river corridors		X	X[a]		X[a]		X[a]	
Areas with high concentration of significant archaeological or historic sites		X[b]		X[c]		X[c]	X	
Sacred sites or American Indian traditional cultural properties		X		X		X		X

[a] New NFS roads and NFS motorized trails are not suitable in segments classified as wild (FSH 1909.12 Chapter 82.51).

[b] New designated motorized areas are not suitable where site densities make data recovery economically infeasible, areas with significant sites that include architecture or structures, or there is a high probability to disturb human remains.

[c] Exceptions may be made where construction or rerouting of a NFS road or motorized trail will protect and/or reduce impacts to cultural resource values.

Recreation Suitability

Table 11 displays areas that are suitable or not suitable for future consideration of projects or activities involving mechanized travel or nonmotorized travel.

Mechanized travel (mechanical transport) is defined as movement using any contrivance over land, water, or air, having moving parts, that provides a mechanical advantage to the user and that is powered by a living or nonliving power source. This includes, but is not limited to, sailboats,

hang gliders, parachutes, bicycles, game carriers, carts, and wagons. It does not include wheelchairs when used as necessary medical appliances. It also does not include skis, snowshoes, rafts, canoes, sleds, travois, or similar primitive devices without moving parts.

Nonmotorized travel (not including mechanized travel) is defined as movement not relying on machines that use a motor, engine, or other nonliving power source (e.g., walking, canoeing, horseback riding).

Table 11. Suitability for mechanized and nonmotorized travel on the Apache-Sitgreaves NFs

Management Area	Mechanized Travel Suitable	Mechanized Travel Not Suitable	Nonmotorized Travel[a] \ Suitable	Nonmotorized Travel[a] Not Suitable
General Forest	X		X	
Community-Forest Intermix	X		X	
High Use Developed Recreation Area	X		X	
Energy Corridor	X		X	
Wild Horse Territory	X		X	
Wildlife Quiet Area	X		X	
Natural Landscape	X		X	
Recommended Research Natural Area		X	X	
Research Natural Area		X	X	
Primitive Area		X	X	
Recommended Wilderness		X	X	
Wilderness		X	X	
Other Areas				
Meadows, wetlands, riparian areas, and along stream bottoms		X	X	
Eligible or suitable wild and scenic river corridors	X[b]		X	

[a] Does not include mechanized travel.

[b] Mechanized travel is not suitable in segments classified as wild.

Chapter 5. Monitoring Strategy

Introduction

The purpose of monitoring and evaluation is to evaluate, document, and report how the land management plan is applied, how well it works, and if its purpose and direction remain appropriate. Monitoring determines actual conditions and compares them with desired conditions. Evaluation of monitoring results may identify that desired conditions are not being met and propose alternative management strategies.

Adaptive management allows the use of alternative solutions to meet desired conditions. It includes defining measurable objectives, monitoring, learning and making changes, and recognizing and adjusting for the uncertainties of outcomes. This “Land Management Plan for the Apache-Sitgreaves National Forests” (the plan) is an integral part of the adaptive management cycle that includes management decisions and actions. Monitoring and evaluating the effects of plan implementation is critical to adaptive management.

The monitoring strategy outlines the general framework for achieving plan monitoring and includes the monitoring questions and select monitoring methods listed in the following section. Monitoring questions focus on key plan decisions where carrying out projects and activities are likely to cause a change over time. It does not address project level implementation monitoring nor is it intended for research purposes. The adaptive management cycle also includes an approach for responding to changing conditions or public desires and to new information, including research and scientific papers.

The forest supervisor evaluates the monitoring information displayed in the evaluation reports through a management review and determines if any changes are needed in management actions or the plan itself. In general, biennial evaluations of the monitoring information consider the following questions:

- What are the effects of resource management activities on the productivity of the land?
- To what degree are resource management activities maintaining or making progress toward the desired conditions and objectives identified in the plan? Are costs of implementing programs occurring as predicted?
- What modifications are needed to account for unanticipated changes in conditions?

The plan is revised at least every 15 years and the forest supervisor may amend the plan at any time. All of the monitoring and evaluation timeframes identified in this chapter begin from the date of the record of decision.

The monitoring and evaluation strategy (plan decisions) below is displayed in table 12. The information outside of this table is not a plan decision but is provided for background.

Monitoring Strategy

Table 12 presents the monitoring questions, monitoring methods, and the frequency of measurements needed to address monitoring requirements identified in the provisions of the 2012

Planning Rule[1] to help evaluate the plan and movement toward key desired conditions. In some cases, the monitoring questions and monitoring methods directly measure the accomplishment of meeting desired conditions. In other cases, they measure objectives or guidelines associated with desired conditions.

This monitoring strategy provides guidance in determining monitoring requirements and accomplishments. Monitoring intervals were chosen based on data availability and rate of change of variables to be measured. Some questions with evaluations occurring at monitoring intervals longer than 1 year may require annual data collection. Forest managers may need to prioritize what would be monitored in any given year and would schedule monitoring and evaluation through the annual budget process. Actual budget levels, funding emphasis, and emergence of new issues may affect accomplishment. Partnerships may be developed to accomplish monitoring and evaluation.

Table 12. Apache-Sitgreaves NFs land management plan monitoring questions, monitoring methods and indicators, and monitoring intervals.

Monitoring Questions	Monitoring Method and Indicators	Monitoring Interval
Maintenance and Improvement of Ecosystem Health		
1. Are long-term soil health and productivity desired conditions being maintained or met?	Review a sample of soil-disturbing activities for compliance with best management practices (BMPs) by project and allotment operating instruction implementation.	Annually
2. How well are management activities contributing to desired conditions or maintaining watersheds in a healthy state and meeting Arizona water quality standards?	Review a sample of soil-disturbing activities for compliance with BMPs by project; allotment operating instruction implementation; Section 18 reviews of allotment National Environmental Policy Act (NEPA); burn area emergency response (BAER) assessments; and Arizona Department of Environmental Quality water quality data.	Every 5 years
3. How are management activities contributing to desired conditions or affecting riparian habitats, including wetlands, on the forests? Are riparian areas attaining and/or moving toward proper functioning condition? Are identified ecological indicators (e.g., aspen, riparian) present and fulfilling their ecological function?	Review a sample of ground-disturbing activities for compliance with BMPs by project; allotment operating instruction implementation; prescribed fire burn plan implementation; proper functioning data or other approved Forest Service methodologies; and Section 18 reviews of allotment NEPA. Monitor riparian habitats for changes in ground cover, species composition, bank stability, and water quality.	Every 5 years
4. Are management activities contributing to desired conditions or improving air quality across the forests in Class 1 (Mount Baldy Wilderness) and Class II airsheds?	Review interagency monitoring of protected visual environments' data.	Annually

[1] The transition provision, 36 CFR § 219.17(b)(3), of the 2012 Planning Rule (77 FR 21162-21276) allows use of the provisions of the planning rule, commonly called the 1982 Planning Rule, to amend or revise plans.

Monitoring Questions	Monitoring Method and Indicators	Monitoring Interval
5. Are habitats for threatened, endangered, sensitive, and other species for the forests being maintained or enhanced; meeting recovery objectives; moving toward desired conditions; and contributing to species viability?	Review implementation of biological opinion terms and conditions and aquatic habitat and population surveys using current approved methodologies. Review implementation and evaluate effectiveness of project mitigation measures affecting habitat.	Annually, on selected newly implemented and ongoing activities
6. Are PNVTs and habitat needs being provided for and contributing to desired conditions? What percent of grasslands have more than 10 percent of encroachment of woody species?	Review mid-scale vegetation assessment and percent change; stand exam data; post-prescribed fire monitoring plots; forest inventory analysis (FIA) plots; change in species composition and soil condition (range data); and acres of restored grassland.	Every 5 years
7. What is the effect of management upon habitat trends of ecological indicators (aspen, riparian) across the forests?	Conduct aspen/riparian monitoring in accordance with species' specific protocols in both treated and untreated areas and in burned (within large wildfire burns) and unburned areas. Interdisciplinary team review the annual aspen/riparian ecological indicator species monitoring reports to determine trend.	Annually Every 5 years
8. How are management activities affecting late successional forest structure in relation to desired conditions?	Review amount and type of restoration treatments and the mid-scale vegetation assessment and percent change; FIA plots; post-prescribed fire monitoring plots; BAER assessments; and percent departure from desired condition by PNVT.	Every 5 years
9. What is the status of Mexican spotted owls as a focal species?	Information on breeding Mexican spotted owl occupancy in areas where they are known to occur and surveys or inventory efforts where their occupancy status is unknown (or areas presumed to be abandoned) will allow us to make inferences regarding the overall status of this species in mixed conifer PNVTs. Conduct project and non-project area monitoring of Mexican spotted owl protected activity centers in accordance with species-specific protocols.	Annually
10. What is the status of northern goshawks as a focal species?	Information on breeding northern goshawk occupancy in areas where they are known to occur and surveys or inventory efforts where their occupancy status is unknown (or areas presumed to be abandoned) will allow us to make inferences regarding the overall status of this species in the ponderosa pine PNVT. Conduct project and non-project area monitoring of northern goshawk post-fledging areas in accordance with species-specific protocols.	Annually
11. What is the status of American pronghorn as a focal species?	To assess grassland PNVT habitat connectivity, obtain AZGFD population distribution data for American pronghorn populations.	Annually

Monitoring Questions	Monitoring Method and Indicators	Monitoring Interval
12. Are management activities contributing to progress towards desired conditions for grassland habitat during the fawning period for American pronghorns?	Review AZGFD data for American pronghorns, including fawn:doe ratios and population trends.	Annually
13. Are management activities moving vegetation communities and habitats closer to the desired condition identified at the appropriate scales as compared to baseline conditions?	Review mid-scale vegetation assessment/percent change in developmental structural states, range analyses (transect data, photo plots, inspections), Forest Inventory and Analysis, Common Stand Exams, production and utilization surveys; Section 18 reviews of allotment NEPA; BAER assessments; fuels inventory; acres of aspen dominated and codominated forested PNVTs; and percent departure from desired condition by PNVT. Review data sources listed above for departure or PNVT changes not explained by mechanical treatment, wildfire, natural succession or other ground disturbing event, as compared to baseline mid-scale (2012). Review applicable indicators for all PNVTs: seral state diversity, ground cover, ecological status, patch size, disturbance regime (fire, insect, disease, flooding), coarse woody debris, snag density, fire regime condition class, riparian function assessment.	Every 5 years
14. Is long term water quality (temperature) being maintained in aquatic systems to meet State of Arizona water quality standards for designated uses? What temperature change is attributed to climate vs. mechanical/wildfire treatments? Are water temperature changes correlated with climate vulnerability predictions for ASNFs watersheds?	Analyze forest stream temperature network data in comparison to available air temperature and streamflow data. Compare long-term trends in ADEQ monitoring data with forest monitoring data and CCVA predictions.	Every 5 years
15. Are insect and disease populations within reference conditions? Are invasive plant species' populations changing substantially? Are their population levels compatible with achieving vegetation desired conditions and management approaches? Are changes and levels consistent with regional changes and levels? What is the relationship between these stressors and climate vulnerability predictions?	Review forest health surveys and report, stand exams, project inspections and reviews, and noxious weeds and nonnative invasive species surveys and treatment reports. Compare ASNFs to Southwest Region insect and disease population levels and trends to determine if change can be attributed to general decline in forest health in high vulnerability ERUs.[2]	Annually, forestwide Every 5 years

[2] Ecological Response Unit (ERU) is equivalent to PNVT; ERU nomenclature has been updated.

Monitoring Questions	Monitoring Method and Indicators	Monitoring Interval
16. Has ASNFs' Climate Change Vulnerability Assessment (CCVA) by ERU changed over the life of the forest plan? How do current climate patterns, over the life of the forest plan, compare to vulnerability predictions for the ASNFs?	Compare CCVA assessments over time to determine change in vulnerability by ERU, local unit and sub-watershed.	Every 5 years
17. Has timber suitability classification changed on any forests' lands?	Reapply timber suitability criteria and process.	Every 10 years
18. Are forest and woodland stands adequately restocked within 5 years of final harvest treatment or after fire-created regeneration openings? Are these restocked areas retaining species composition and density compared to baseline PNVT? Are stocking patterns correlated with climate vulnerability predictions?	Review annual reforestation needs report, stocking certifications, silvicultural prescriptions, timber/silvilculture tracking database. Assess species composition and density in restocked areas relative to baseline PNVT range of variability.	Every 5 years
19. How is harvest unit size affecting landscape patterns across the forests?	Review mid-scale vegetation assessment and percent change.	Every 5 years
Managed Recreation		
20. Do recreational opportunities respond to forest users' desires, needs, and expectations?	Review recreation use surveys and acres by recreation opportunity spectrum (ROS).	Every 5 years
21. How are recreational activities (including off-highway vehicle use) affecting the physical and biological resources of the forests?	Review law enforcement warnings and citations regarding resource damage; amount of soil surface cover on routes or areas closed to motor vehicle travel; acres of noxious weeds and invasive nonnative species treated in developed campgrounds and dispersed camping areas; and trail condition surveys.	Annually
22. How are projects and programs affecting scenic integrity?	Conduct management reviews.	Annually
23. Are the forests' infrastructure (e.g., recreation facilities, roads, trails) and their ability to facilitate administrative needs and attainment of desired conditions for administrative uses and recreational opportunities, including access, sustainable?	Estimate amount of deferred maintenance (recreation and transportation).	Every 5 years
24. Are eligible and suitable wild and scenic rivers being managed to protect and enhance the identified outstandingly remarkable values?	Conduct management reviews of projects and ongoing activites within river corridors.	Every 2 years

Monitoring Questions	Monitoring Method and Indicators	Monitoring Interval
25. Are designated wilderness and the primitive area being managed to maintain the wilderness values and character?	Conduct management reviews of projects and ongoing activities within designated wilderness and the primitive area.	Every 2 years
26. Are recommended wilderness being managed to protect the wilderness values and character?	Conduct management reviews of projects and ongoing activities within recommended wilderness.	Every 2 years
Community-Forest Interaction		
27. How well are the forests interacting and planning in cooperation with communities?	Conduct management reviews and review number of tribal agreements and acres of community wildfire protection plan treated. Review number of grants, agreements, and volunteers and type of resource benefit.	Every 5 years
28. Do the forests provide interpretive opportunities that describe natural resources and the Forest Service mission?	Review number and type of interpretive programs conducted.	Every 5 years
29. Are outputs of goods and services being produced at a rate consistent with projections?	Review allowable sale quantity (ASQ) compared to actual sale quantity; number of firewood permits issued; number of cords of firewood sold; tons of biomass sold; number of Christmas tree permits sold; number of livestock permitted and actual use records; and number of forest products permits issued.	Every 5 years
Other		
30. Are there changes that have resulted in unforeseen issues requiring plan amendments?	Review the number of forest plan amendments and conduct a content analysis on those amendments.	Every 5 years
31. Are plan objectives being achieved?	Report completed accomplishments toward meeting plan objectives.	Annually
32. Are the standards and guidelines prescribed being incorporated in NEPA documents and implemented in projects and activities?	Review the number of forest plan amendments and NEPA decision documents that deviate from forest plan standards and guidelines. Conduct management reviews of selected projects and activities.	Annually
33. What is the condition of archaeological sites and traditional cultural properties on ASNFs?	Inventory and assessment of cultural resources from surveys conducted pre- and post- project and program monitoring; and stewardship actions taken, including preservation, stabilization, research, interpretation, partnerships, volunteer opportunities, and other forms of public outreach.	Every 2 years

List of Preparers

The following individuals significantly contributed to development of the “Land Management Plan for the Apache-Sitgreaves National Forests” as members of the interdisciplinary plan revision team.

Team Members

- Pam Baltimore, Public Affairs Officer
- Russell Bigelow, Fuels Specialist
- Monica Boehning, Silviculturist
- Randall L. Chavez, Recreation and Lands Staff
- Tamara Conner, Environmental Coordinator
- Paula Cote, Environmental Coordinator
- Bob Csargo, Wildlife Biologist
- Michelle W. Davalos, Forest Planner
- Ryan Domsalla, Recreation and Lands Program Manager
- Cathy Dowd, Acting Forest Planner
- Beth Dykstra, Realty Specialist and Acting Recreation Program Manager
- Bob Dyson, Public Affairs Officer
- David Evans, Range Program Manager
- Genice Froehlich, Wildlife Biologist
- Joseph A. Hamrick, Silviculturist
- Jeremy Human, Fuels Specialist
- Charlotte Hunter, Heritage Program Manager and Tribal Liaison
- Deryl Jevons, Planning Staff Officer
- Margaret Kirkeminde, GIS Specialist
- Susan Lee, Fuels Specialist
- Nancy Loving, GIS Specialist
- Gary Miller, Engineer
- Chris Nelson, Watershed Program Manager
- Debbie MacIvor, Engineer
- Daniel Mindar, Fuels Specialist
- Judy Palmer, Fuels Specialist
- Adriane Ragan, Writer/Editor
- Julia Faith Rivera, Writer/Editor
- James Schroeder, Fuels Specialist
- Melissa Schroeder, Heritage Program Manager and Tribal Liaison
- Joe Sitarzewski, Lands and Minerals Program Manager
- Tom Subirge, Soil Scientist
- Evelyn Treiman, Recreation Planner
- Jerry Ward, Fish Biologist
- Mitchel R. White, Ecologist

- Linda WhiteTrifaro, Wildlife Biologist
- Cathy Taylor, Wildlife Biologist
- Pete Taylor, Archeologist
- Denise VanKeuren, Range Program Manager

In addition, numerous individuals and groups provided input into the development of this plan. Some of these include the following:

- Members of the public; tribes; county, State, Federal, and local agencies; and nongovernmental organizations provided review and input.
- The forests’ leadership team, especially three deputy forest supervisors Tom Osen, Bill Pell, and Christine Dawe, and four forest supervisors—Tom Osen, James Zornes, Chris Knopp, and Elaine Zieroth—provided direction and oversight.
- The employees of the Apache-Sitgreaves NFs provided review and input, especially the staffs of Alpine, Black Mesa, Clifton, Lakeside, and Springerville Ranger Districts.
- The Southwestern Region Plan Revision Team provided oversight and guidance.

Glossary

Adequate access – A route and method of access to non-Federal land that provides for reasonable use and enjoyment of the non-Federal land consistent with similarly situated non-Federal land and that minimizes damage or disturbance to NFS lands and resources (36 CFR § 251.111).

Adjudication – The legal process by which an arbiter or judge reviews evidence and argumentation, including legal reasoning, set forth by opposing parties or litigants to come to a decision which determines water rights and obligations between the parties involved.

Administrative use – Use by the Forest Service.

Aquatic habitat – A specific type of area with environmental (i.e., biological, chemical, or physical) characteristics needed and used by an aquatic organism, population, or community.

Air quality related value – A scenic, cultural, physical, biological, ecological, or recreational resource which may be affected by a change in air quality as defined by the Federal land manager for Federal lands.

Age class – Trees or plants that originated within a relatively distinct range of years. Typically the range of years is considered to fall within 20 percent of the average natural maturity of a particular species (e.g., if 100 years is required to reach maturity, then there would be five 20-year age classes).

Allowable sale quantity (ASQ) – The quantity of timber that may be sold from the area of suitable land covered by the land management plan for a time period specified by the plan. This allowable sale quantity (ASQ) is usually expressed on an annual basis as the “average annual allowable sale quantity.” For timber resource planning purposes, the allowable sale quantity applies to each decade over the planning horizon and includes only chargeable volume. Consistent with the definition of timber production, do not include firewood or other nonindustrial wood in the allowable sale quantity.

Aquatic management zones – An area of vegetation or forest litter located adjacent to stream courses and/or riparian areas for the purpose of filtering sediment, providing bank stability, and providing shade for fisheries habitat in tree/shrub ecosystems.

Aspen clone – A genetically identical set of aspen trees all connected by the same root system, such that they can be vegetatively propagated. A clone may be a distinct aspen stand, or it may be a smaller inclusion within a conifer stand, or it may cover an entire mountainside as a large stand or patch.

Available forage – That amount of growth of a vigorous and healthy plant that can be utilized as feed (regardless of what animal is using it) without impairing the plant’s long term health and productivity or other uses such as riparian filtering. The amount of available forage may be less where there is a need to restore health and vigor of forage plants. That amount may also depend on time of year and plant physiological stage or other conditions such as drought.

Basal area – The cross-sectional area of the stem or the stems of the plant or all plants in a stand. Herbaceous and small woody plants are measured at diameter at root collar (DRC) or near ground level; larger woody plants are measured at diameter at breast height (DBH) or other appropriate height. Basal area is a way to measure how much of a site is occupied by plants; it is expressed in square feet per acre for woody species.

Beneficial uses of water – Beneficial use of water from rivers and streams is allocated by prior appropriation, meaning the first user to divert water and put it to a “beneficial use” obtains a priority right, and that right is to be satisfied before any other user has access to the water. The definition of what constitutes a “beneficial use” has evolved. Although the Arizona Legislature added habitat for wildlife and fish as one of the beneficial uses in 1941, it wasn’t until 1976 that the court ruled this included a right for instream flow, and the first instream flow permit was not issued until 1990. Obtaining a permit for instream flow allows users to leave their allocation of water in the river rather than diverting, consuming, or losing it for nonuse.

Best management practices (BMPs) – Methods, measures, or practices selected by an agency to meet its nonpoint source control needs. BMPs include, but are not limited to, structural and nonstructural controls and operation and maintenance procedures. BMPs can be applied before, during, and after pollution-producing activities to reduce or eliminate the introduction of pollutants into receiving waters (40 CFR § 130.2(m)).

Biological diversity – The variety of the Apache-Sitgreaves NFs’ organisms, the ecological complexes in which they occur, and the processes and life support services they facilitate.

Browser – Animals that eat twigs and leaves of woody plants. An example of a browser is deer.

Candidate species – Plant and animal taxa considered for possible addition to the list of endangered and threatened species. These are taxa for which the U.S. Fish and Wildlife Service has sufficient information on biological vulnerability and threat(s) on file to support issuance of a proposal to list, but issuance of a proposed rule is currently precluded by higher priority listing actions.

Cave – Any naturally occurring void, cavity, recess or system of interconnected passes beneath the surface of the earth or within a cliff or ledge which is large enough to allow an individual to enter. This includes shallow alcoves in rock faces or on steep slopes of that size.

Class I airshed – An airshed classification where areas require the highest level of protection under the Clean Air Act of 1963.

Class II airshed – An airshed classification representing National Forest System land that is not classified as a Class I airshed. These areas may receive a greater amount of human-caused pollution than Class I areas.

Clear-cutting regeneration method – The cutting of essentially all trees, producing a fully exposed microclimate for the development of a new age class. This includes coppice cutting.

Climate change – Refers to long-term (decades or longer) trends in climate averages, such as the global warming that has been observed over the past century, and long term changes in variability (e.g., frequency, severity, and duration of extreme events).

Climate variability – Refers to shorter term (daily, seasonal, annual, interannual, several years) variations in climate, including the fluctuations associated with El Niño (wet) or La Niña (dry) events.

Clump – A tight cluster of two to five trees of similar age and size originating from a common rooting zone that typically lean away from each other when mature. A clump is relatively isolated

from other clumps or trees within a group of trees, but a stand-alone clump of trees can function as a tree group.

Coarse woody debris – Woody material, including logs, on the ground greater than 3 inches in diameter—a component of litter. Large coarse woody debris is often considered to be downed logs at least 12 inches in diameter and 8 feet in length.

Common variety minerals – Common variety minerals/salable mineral materials are synonymous terms for the same class of minerals that can be sold under a mineral material contract and are common. These minerals are relatively low value per volume such as sand, gravel, cinders, common building stone, and flagstone. Many of the materials are used for road surfacing, boulders, and engineering construction or may be specialty resources such as soil amendments or decorative stone, including flagstone. These minerals are typically sold unless used internally, by another government agency, or for ceremonial uses. In these cases they may be provided free of charge.

Communications site – An area of National Forest System land used for telecommunications services. A communications site may be limited to a single communications facility, but most often encompasses more than one facility. Existing Apache-Sitgreaves NFs communications sites are listed in appendix C.

Communities-at-risk – As identified in the Federal Register, high risk urban communities within the wildland-urban interface.

Community wildfire protection plans (CWPPs) – Plans for at-risk communities that identify and prioritize areas for hazardous fuels treatments. The CWPPs that cover the Apache-Sitgreaves NFs include CWPP for the At-Risk-Communities in Apache County, CWPP for the At-Risk-Communities in Greenlee County, and the Sitgreaves CWPP (includes Apache, Coconino, and Navajo Counties).

Condition class – The Forest Service Manual (FSM 2521.1) uses three classes to describe watershed condition:

- **Class 1** watersheds exhibit high geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and are functioning properly.
- **Class 2** watersheds exhibit moderate geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and are functioning at risk.
- **Class 3** watersheds exhibit low geomorphic, hydrologic, and biotic integrity relative to their natural potential condition and their function is impaired.

Connectivity – The arrangement of habitats that allows organisms and ecological processes to move across the landscape; patches of similar habitats are either close together or linked by corridors of appropriate vegetation; the opposite of fragmentation.

Coppice regeneration method – An even-aged method of regenerating a stand in which the trees in the previous stand are cut and the majority of regeneration is from sprouts or root suckers, such as used in regenerating aspen stands.

Critical area – A critical area for grazing management is an area which should be treated with special consideration because of inherent site factors, size, location, condition, values, or

significant potential conflicts among uses. Critical areas are evaluated separately from the remainder of a management unit because they contain special or unique values such as riparian areas (Bureau of Land Management, 1999).

Critical habitat – When a species is listed as endangered or threatened under the Endangered Species Act (ESA), it is protected which includes protection of the habitat it occupies. In addition, specific areas may be designated as particularly necessary for the species' recovery whether the species is present or not; these areas are called "critical habitat." Besides requiring Federal agencies to ensure that their actions will not jeopardize the survival of an endangered or threatened species itself, the ESA also requires that their actions not destroy or adversely modify designated critical habitat. ESA requirements have no implications on non-Federal lands unless activities thereon are undertaken with Federal funding or require a Federal permit.

Culmination of mean annual increment – The age in the growth cycle of an even-aged stand at which the average annual rate of wood volume growth has peaked and is beginning to steadily decline.

Cultural affiliation – A relationship of shared group identity which can be reasonably traced historically or prehistorically between a present day Indian tribe or Native Hawaiian organization and an identifiable earlier group (25 USC 3001 (2)).

Declining – The senescent (aging) period in the lifespan of plants that includes the presence of dead and/or dying limbs, snag tops, and other characteristics that indicate the later life stages of vegetation.

Defensible space – An area either natural or manmade where material capable of allowing a fire to spread has been treated, cleared, reduced, or changed to act as a barrier between an advancing wildland fire and property or resources. In practice, "defensible space" is defined as an area a minimum of 30 feet around a structure that is cleared of flammable brush or vegetation.

Departure (departed) – The relative difference between existing and desired conditions or reference conditions.

Developed recreation site – A distinctly defined area where facilities are provided by the Forest Service for concentrated public use (e.g., campgrounds, picnic areas, swimming areas).

Diameter – The diameter of a tree species, usually measured by two primary methods:

- **Diameter at breast height (DBH)** – The diameter of a forest tree species at the bole (or trunk), typically measured at 4.5 feet above ground level.
- **Diameter at root collar (DRC)** – The diameter of a woodland tree species, typically measured at the root collar (the part of a tree where the main roots join the trunk, usually at or near ground level) or at the natural ground line, whichever is higher.

Dispersed recreation – Outdoor recreation in which visitors are spread over relatively large areas. Where facilities or developments are provided, they are more for access and protection of the environment than for the comfort or convenience of the visitors.

Ecological disturbance – An event or force that brings about mortality to organisms and changes in their spatial patterning in the ecosystems they inhabit. Disturbance plays a significant role in shaping the structure of individual populations and the character of whole ecosystems.

Ecological process – The four fundamental ecological processes of ecosystems are the water cycle, nutrient cycle, energy cycle, and community dynamics or succession (i.e., how the composition and structure of an ecosystem changes following a disturbance).

Ecological restoration – The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed. Ecological restoration focuses on establishing the composition, structure, pattern, and ecological processes necessary to facilitate terrestrial and aquatic ecosystem sustainability, resilience, and health under current and future conditions. In the Southwestern Region, achievement of desired conditions means that the ecosystem has been restored. Restoration treatments are those that move ecosystem components toward desired conditions.

Ecological status – Ecological status is the degree of similarity between the existing vegetation (all components and their characteristics) and existing soil conditions compared to the potential natural plant community and the desired soil condition on a site. The present state of a TES map unit stated in terms of specific values or potentials with respect to species composition, ground cover, and soil characteristics. Ecological status is often evaluated on the basis of similarity indices between current conditions and the potential natural vegetation community (Forest Service, 1999). Ecological status ratings are: high, moderately-high, moderate-low, and low (FSH 2209.21, Southwestern Region). The relationship between ecological status and range condition are: excellent and good range condition represents high ecological status, signifying no and low departure from desired conditions; fair range condition represents moderately-high ecological status, signifying moderate departure from desired conditions; poor range condition represents moderately-low ecological status, signifying high departure from desired conditions; and very-poor range condition represent low ecological status, signifying severe departure from desired conditions.

Ecosystem – A spatially explicit, relatively homogeneous unit of the earth that includes all interacting organisms and components of the abiotic (nonliving) environment within its boundaries. An ecosystem is commonly described in terms of its: (1) composition: major vegetation types, rare communities, aquatic systems, and riparian systems; (2) structure: successional stages, water quality, wetlands, and floodplains; and (3) function: ecological processes such as streamflows and natural disturbance regimes.

Ecosystem diversity – The variety of ecosystems present on the Apache-Sitgreaves NFs, as represented by the 14 potential natural vegetation types and the variety of species (both plant and animal), their habitats, and ecological processes that occur in their different physical settings.

Ecosystem services – Benefits obtained from ecosystems, including (1) provisioning services such as food, fresh water, fuel, and fiber; (2) regulating services such as climate, water, pollination, and disease regulation; (3) supporting services such as soil formation and nutrient cycling; and (4) cultural services such as educational, aesthetic, and cultural values as well as recreation and tourism opportunities.

Ecotone – A transition area of vegetation between two communities, having characteristics of both kinds of neighboring vegetation, as well as characteristics of its own. Varies in width depending on site and climatic factors.

Escaped prescribed fire – A prescribed fire that has exceeded or is expected to exceed prescription parameters or otherwise meets the criteria for conversion to wildfire. Criteria are specified in Interagency Prescribed Fire – Planning and Implementation Procedures Reference Guide.

Emergent vegetation – Erect plants rooted under water that grow above (emerge from) the surface of the water (e.g., cattail, bulrush).

Encumbrance – Any right or interest in land, held by someone other than the owner, that may or may not be consistent with the owner's use. Among other things, encumbrances may consist of mortgages, deeds of trust, agreements for support, life estates, leases, tax liens, outstanding mineral rights, reservations, restrictions, and rights of reverter.

Endemic – (1) Describes a population that has unique genetic characteristics and likely exists in a very limited geographic area. (2) Describes a population of native insects, diseases, plants, or animals which perform a functional role in the ecosystem when they are present at low levels, or constantly attack just a few hosts throughout an area but can become potentially injurious when they increase or spread to reach outbreak (epidemic) levels.

Energy corridor – A linear strip of land identified for the present or future location of utility right-of-way (e.g., above or below ground electric transmission line, gas pipeline).

Ephemeral wetlands – Wetlands that exist for a short period following precipitation or snowmelt; they are temporary and not the same as intermittent or seasonal wetlands, which exist for longer periods but not yearlong.

Equine – Horses, mules, and asses. [adapted from Arizona Revised Statue, Title 3 – Agriculture, Chapter 11 (Ownership, Control and Regulation of Livestock), Article 1, 3-1201 (Definitions)].

Even-aged stands – Stands that are composed of one or two distinct age classes of trees.

Even-aged management – The application of a combination of actions that result in the creation of stands in which trees are essentially the same age. Managed even-aged forests are characterized by a distribution of stands of varying ages (and, therefore, tree size) throughout the forest area. Clearcut, shelterwood, or seed tree cutting methods produce even-aged stands.

Federally listed species (listed species) – Any species of fish, wildlife, or plant which has been determined to be endangered or threatened under section 4 of the Endangered Species Act.

Federal reserved water rights (reserved rights) – When Congress designates Federal lands for a specific purpose, it also reserves sufficient water to serve the purposes of that designation. These water rights are known as "Federal reserved water rights" or simply, reserved rights. Reserved rights are implied rights, meaning that Congress need not expressly state in a bill that it intends to reserve Federal water right. The right exists whether or not Congress explicitly mentions it.

Feral animal – ". . . animals, including horses, burros, cattle, swine, sheep, goats, reindeer, dogs, and cats, without ownership, that have reverted to the wild from a domestic state . . ." (50 CFR 30.11). Feral horses and burros are animals that do not meet the definition of a wild free-roaming horse in accordance with 36 CFR 222.60(b)(13).

Fire intensity – The product of the available heat of combustion per unit of ground and the rate of spread of the fire, interpreted as the heat released per unit of time for each unit length of fire edge. The primary unit is British thermal unit per second per foot (Btu/sec/ft.) of fire front. See also fire severity.

Fire regime – The patterns, frequency, and severity of fire that occur over a long period of time across a landscape and its immediate effects on the ecosystem in which it occurs. There are five fire regimes which are classified based on frequency (average number of years between fires) and severity (amount of replacement of the dominant overstory vegetation) of the fire.

- **Fire regime I** – 0 to 35-year frequency and low (surface fires most common) to mixed severity (less than 75 percent of dominant overstory vegetation replaced)
- **Fire regime II** – 0 to 35-year frequency and high (stand replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced)
- **Fire regime III** – 35 to 100+ year frequency and mixed severity (less than 75 percent of the dominant overstory vegetation replaced)
- **Fire regime IV** – 35 to 100+ year frequency and high (stand replacement) severity (greater than 75 percent of the dominant overstory vegetation replaced)
- **Fire regime V** – 200+ year frequency and high (stand replacement) severity.

Fire risk – The chance of fire starting, as determined by the presence and activity of causative agents.

Fire severity – Degree to which a site has been altered or disrupted by fire; also used to describe the product of fire intensity and residence time; usually defined by the degree of soil heating or mortality of vegetation.

Fireline – The part of a containment or control line that is scraped or dug to mineral soil.

Fire management plan – A plan that identifies and integrates all wildland fire management and related activities within the context of approved land management plans. It defines a program to manage wildland fires (wildfire and prescribed fire).

Free-flowing – Existing or flowing in natural conditions without impoundment, diversion, straightening, rip-rapping, or other modification of the waterway.

Fugitive dust – Fine particulate matter from windblown soil and dust which becomes airborne.

Firewood – Wood grown or used for fuel.

Functioning ecosystem – An ecosystem that contains all components and processes necessary to maintain resilience over time.

Genetic exchange – The exchange of genetic material between individuals and/or populations through sexual reproduction.

Genotype – The genetic makeup of an organism or group of organisms.

Geomorphic – Refers to the process of erosion and sediment transport and deposition.

Goshawk foraging areas – Areas that surround goshawk PFAs (post-fledging family areas) that northern goshawks use to hunt for prey. They are approximately 5,400 acres in size (not including the PFA or nesting area acres).

Goshawk nest areas – Areas immediately around a nest that are used by northern goshawks in relation to courtship and breeding activities. They are approximately 30 acres in size and contain multiple groups or patches of large, old trees with interlocking crowns.

Goshawk post-fledging family areas (PFAs) – Areas that surround nest areas. They represent an area of concentrated use by the northern goshawk family until the time the young are no longer dependent on adults for food. PFAs are approximately 420 acres in size (not including the nest area acres).

Groundwater-dependent ecosystems – Communities of plants, animals, and other organisms whose extent and life processes are dependent on access to or discharge of groundwater. (USDA FS 2012c).

Group – A cluster of two or more trees with interlocking or nearly interlocking crowns at maturity surrounded by an opening. Size of tree groups is typically variable depending on forested PNVT and site conditions and can range from fractions of an acre (a two-tree group) (i.e., ponderosa pine, dry mixed conifer) to many acres (i.e., wet mixed conifer, spruce-fir). Trees within groups are typically non-uniformly spaced, some of which may be tightly clumped.

Group selection – An uneven-aged management method in which trees are removed and new age classes are established in groups, adjacent to other groups of different age classes. Group cut size is determined by the reproduction requirements of the species desired and by the number or total acreage of different age classes desired across the stand.

Habitat – The physical location or type of environment in which an organism or biological population lives or occurs.

Half-shrub – Half-shrubs have a woody base and lower stems but the top growth remains herbaceous during the growing season.

Herbaceous – Grass, grass-like, and/or forb vegetation.

Herbivory – Loss of vegetation due to consumption by another organism.

Highly interactive species – A species that has a disproportionate effect on its ecosystem. The virtual or effective absence of a highly interactive species leads to significant changes in some feature of its ecosystem. Such changes include structural or compositional modifications, alterations in the import or export of nutrients, loss of resilience to disturbance, and decreases in native species diversity. The type of interactions these species have with their surrounding environment is critical to the persistence of certain ecosystem features through time. Examples of

strong interactions include mutualisms (e.g., pollinators such as butterflies and spore and seed dispersers such as birds), consumers (e.g., large predators such as mountain lions), and ecosystem engineers (e.g., prairie dogs, beavers).

Hydraulic – Refers to the mechanical properties of water.

Hydrologic – Refers to the movement, distribution, and quality of water.

Hydrologic function – The behavioral characteristics of a watershed described in terms of ability to sustain favorable conditions of water flow. Favorable conditions of water flow are defined in terms of water quality, quantity, and timing**.**

Hydrologic Unit Code (HUC) – The United States is divided and subdivided into successively smaller hydrologic units which are identified by unique hydrologic unit codes (HUCs). The Apache-Sitgreaves NFs is contained within three 3rd level (basin) HUC watersheds: Little Colorado, Gila, and Salt Rivers. The Apache-Sitgreaves NFs intersect thirteen 4th level (subbasin) HUC watersheds, thirty-two 5th level (watershed) HUC watersheds, and two hundred and fifteen 6th level (subwatershed) HUC watersheds. The average size of a 4th level HUC watershed is 1 million acres, 5th level HUC watersheds are around 165,000 acres, and 6th level HUC watersheds are about 21,000 acres.

Individual tree selection – An uneven-aged management method where individual trees of all size classes are removed more or less uniformly throughout the stand, to promote growth of remaining trees and to provide space for regeneration.

Instream flow – Seasonal streamflows needed for maintaining aquatic and riparian ecosystems, wildlife, fisheries, and recreation opportunities at an acceptable level.

Interspaces – As defined by RMRS-GTR-310 (Reynolds et al., 2013), interspaces are areas within a stand that are not currently under the vertical projection of the outermost perimeter of tree canopies (drip-line). They are generally composed of grass-forb-shrub cover but could also be areas with scattered rock or exposed mineral soil. As spaces between trees, tree groups and tree clumps, interspaces contribute to the “open canopy” character of frequent-fire forests. They often connect with other interspaces and thus are variably shaped and sized. See “openings.”

Intrinsic qualities – For scenic byways, intrinsic qualities are the features considered representative, unique, irreplaceable, or distinctly characteristic of an area. They include archaeological, cultural, historic, natural, recreational, and scenic.

Invasive species – Species that are not native to the ecosystem being described and that cause, or have the potential to cause, ecological or economic harm.

Karst – A geological landform existing in an area where the predominant shaping process is controlled by soluble bedrock, usually limestone in nature. Karst landscape is characterized by closed depressions, disappearing streams, and solutional shaping. Classical karst drainage is vertical and underground.

Leasable minerals – Leasable minerals include coal, oil, gas, oil shale, sodium, phosphate, potassium, and geothermal. Leasable minerals also include the hardrock minerals, if they are found on lands that have “acquired” status. Leases are obtained through the Bureau of Land Management to extract these mineral resources.

Leave No Trace – Guidelines that help protect the land and lessen the sights and sounds of forest visitors. http://www.lnt.org/

Lentic – A non-flowing or standing body of water (e.g., pond, lake).

Litter – Litter consists of dead, unattached organic material on the soil surface that is effective in protecting the soil surface from raindrop splash, sheet, and rill erosion and is at least ½ inch thick. Litter is composed of leaves, needles, cones, and woody vegetative debris including twigs, branches, and trunks.

Livestock – Cattle, equine, sheep, goats, and swine, except feral hogs [adapted from Arizona Revised Statue, Title 3 – Agriculture, Chapter 11 (Ownership, Control and Regulation of Livestock), Article 1, 3-1201 (Definitions)].

Livestock grazing – Foraging by permitted livestock (domestic foraging animals of any kind).

Locatable minerals – In general, the hardrock minerals mined and processed for metals (e.g., gold, silver, copper, uranium, and some types of nonmetallic minerals such as sandstone). They are called "locatable," meaning subject to mining claim location under the United States mining laws. Locatable minerals are limited to lands with "reserved public domain" status.

Lotic – A flowing body of water (e.g., stream, river).

Management review – One of the primary components of the overall Forest Service management/internal control system (FSM 1400). Management reviews are used to evaluate internal and administrative controls and to identify successful management, management/internal control weaknesses, and needed corrective actions.

Mechanized travel **(Mechanical transport)** – Movement using any contrivance over land, water, or air, having moving parts, that provides a mechanical advantage to the user and that is powered by a living or nonliving power source. This includes, but is not limited to, sailboats, hang gliders, parachutes, bicycles, game carriers, carts, and wagons. It does not include wheelchairs when used as necessary medical appliances. It does not include skis, snowshoes, rafts, canoes, sleds, travois, or similar primitive devices without moving parts.

Mechanical treatment – For the purposes of this plan, mechanical treatments include most vegetation treatments except fire. They may include mechanized cutting, hand thinning, and other silvicultural treatments.

Metapopulation – A set of partially isolated populations belonging to the same species that can interbreed and recolonize areas where the species has recently become extirpated (i.e., locally extinct).

Mexican spotted owl protected activity center (PAC) – An area established around an occupied Mexican spotted owl site to help ensure successful reproduction and species viability. A PAC is no less than 600 acres in size and includes the best owl nesting and roosting habitat. Management in PACs is focused on forest health and includes retention of key habitat elements such as higher levels of basal area and canopy cover to provide the cool understory conditions owls need and the down woody debris and forage (cover, fungi, seeds) needed by their prey. Management may involve thinning and/or burning to reduce the risk of high intensity wildfire, often with timing

restrictions to prevent disturbance to owls during the breeding season (March 1 through August 31).

Mosaic – Mix of recurring patterns of forested and non-forested areas at the identified scale (e.g., landscape, watershed, mid-scale). Patterns are variable and may change over time.

Motorized travel – Movement using machines that use a motor, engine, or other nonliving power sources other than a vehicle operated on rails or a wheelchair or mobility device , including one that is battery powered, designed solely for the use by a mobility-impaired person for locomotion and that is suitable for use in an indoor pedestrian area.

Motor vehicle use map (MVUM) – The MVUM displays designated roads, trails, and areas on an administrative unit or a ranger district of the National Forest System.

National Forest System (NFS) – As defined in the Forest and Rangeland Renewable Resources Planning Act of 1974 (Public Law 93-378), the "National Forest System" includes all national forest lands reserved or withdrawn from the public domain of the United States, all national forest lands acquired through purchase, exchange, donation, or other means; the national grasslands and land use projects administered under Title III of the Bankhead-Jones Farm Tenant Act (50 Stat. 525, 7 USC 1010-1012); and other lands, waters, or interests therein administered by the Forest Service or are designated for administration through the Forest Service as part of the system.

National Forest System road – A road wholly or partly within or adjacent to and serving the National Forest System that the Forest Service determines is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources. A forest road other than a road which has been authorized by a legally documented right-of-way held by a state, county, or other local public road authority (36 CFR § 212.1).

National Forest System trail – A trail wholly or partly within or adjacent to and serving the National Forest System that the Forest Service determines is necessary for the protection, administration, and utilization of the National Forest System and the use and development of its resources. A forest trail other than a trail which has been authorized by a legally documented right-of-way held by a state, county, or other local public road authority (36 CFR § 212.1).

Native species – A species which is a part of the original fauna or flora in the area in question.

Natural disturbance regime – The historic patterns (frequency and extent) of fire, insects, wind, landslides, floods, and other natural processes in an area.

Natural fire regime – The fire regime that existed prior to human facilitated interruption of frequency, extent, or severity.

Naturalized – A species or subspecies that is not native to an area, but one which has adapted to that area and has a stable or expanding population. In some cases, species move into a new area by themselves, but in most instances they are human-associated introductions.

Natural potential condition – (pertaining to watershed conditions) Conditions that are referred to as pristine and show little or no influence from human actions. Watersheds that are properly functioning have terrestrial, riparian, and aquatic ecosystems that capture, store, and release water, sediment, wood, and nutrients within their range of natural variability for these processes. When watersheds are functioning properly, they create and sustain functional terrestrial, riparian, aquatic, and wetland habitats that are capable of supporting diverse populations of native aquatic- and riparian-dependent species (Forest Service, 2011).

Nonindustrial wood – Includes aspen, junipers, piñon pines, Chihuahuan pine, oaks, and any industrial species cut from non-suitable timberlands. Wood cut as nonindustrial may be used as firewood and/or biomass. Sometimes referred to as non-ASQ species.

Nonmotorized travel – Movement not relying on machines that use a motor, engine, or other nonliving power source (e.g., walking, canoeing, horseback riding).

Nonpoint source pollution (NPS) – NPS refers to water pollution affecting water quality from diffuse sources, such as polluted runoff from agricultural areas draining into lakes, wetlands, rivers, and streams. NPS can be contrasted with point source pollution, where discharges occur to a body of water at a single location, such as discharges from a chemical factory or urban runoff from a roadway or storm drain. NPS may derive from many different sources with no specific solution to rectify the problem, making it difficult to regulate.

Noxious weed – Any plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment. The term typically describes species of plants that have been determined to be undesirable or injurious in some capacity. Federal noxious weeds are regulated by USDA-Animal and Plant Health Inspection Service under the Plant Protection Act of 2000, which superseded the Federal Noxious Weed Act of 1974. When the species are native, they are not considered invasive species by the Federal Government.

Old growth – In southwestern forested ecosystems, old growth is different than the traditional definition based on northwestern infrequent fire forests. Due to large differences among Southwest forested PNVTs and natural disturbances, old growth forests vary extensively in tree size, age classes, presence, and abundance of structural elements, stability, and presence of understory (Helms, ed., 1998). Old growth refers to specific habitat components that occur in forests and woodlands—old trees, dead trees (snags), downed wood (coarse woody debris), and structure diversity (Franklin and Spies, 1991; Helms, ed., 1998; Kaufmann et al., 2007). These important habitat features may occur in small areas, with only a few components, or over larger areas as stands or forests where old growth is concentrated (Kaufmann et al., 2007). In the Southwest, old growth is considered “transitional” (Oliver and Larson, 1996), given that that the location of old growth shifts on the landscape over time as a result of succession and disturbance (tree growth and mortality). Some species, notably certain plants, require “old forest” communities that may or may not have old growth components but have escaped significant disturbance for lengths of time necessary to provide the suitable stability and environment. See appendix B for a more detailed description.

Old growth components – Include old trees, dead trees (snags), downed wood (coarse woody debris), and structural diversity.

Old tree – Any native tree established before natural disturbance patterns were notably altered by Euro-American settlement (generally between 1850 and 1890 on the Apache-Sitgreaves NFs). Such a tree exhibits all or most characteristics of overmaturity for its species, and/or has tree rings revealing its advanced age. For example, old ponderosa pine trees display the following: yellow/orange plates widened between bark furrows, horizontal to drooping limbs, rounded crown tops, and gradual bole taper (see Keen's tree class number 4 in appendix B).

Openings – Generally persistent treeless areas having a fairly distinct shape or size, occurring naturally due to differences in soil types as compared to sites that support forests or woodlands. Openings include meadows, grasslands, rock outcroppings, and wetlands. In contrast, created openings result from disturbances like severe fire or windthrow, or management activities to intentionally create space for new tree regeneration. Natural and created openings are not the same as interspaces found in the frequent-fire forests or woodlands. See "interspaces."

Other energy development – Infrastructure associated with the provision or transport of energy (e.g., biomass power generation, wind turbines, solar panels).

Outstanding Arizona Waters – Surface water designated by Arizona Department of Environmental Quality as an outstanding State water resource. These are waters with exceptional quality where water quality should not be degraded.

Patches – Areas larger than tree groups in which the vegetation composition and structure are relatively homogeneous. Patches compose the mid-scale, thus they range in size from 100 to 1,000 acres.

Phenotype – The visible characteristics of an organism resulting from the interaction of its genetic makeup and environment.

Plan set of documents – The complete set of documentation supporting the land management plan; it may include, but is not limited to, evaluation reports, documentation of public involvement, the plan including applicable maps, applicable plan improvement documents, applicable NEPA documents, and the monitoring program for the plan area.

Planned ignition – The intentional initiation of a wildland fire by hand-held, mechanical, or aerial device where the distance and timing between ignition lines or points and the sequence of igniting them is determined by environmental conditions (e.g., weather, fuel, topography), firing technique, and other factors which influence fire behavior and fire effects. See prescribed fire.

Planning period – The life of the plan, generally 10 to 15 years from plan approval.

Potential natural vegetation type (PNVT) – Coarse-scale groupings of ecosystem types that share similar geography, soils, vegetation, and historic ecosystem disturbances such as fire, drought, and grazing by native species. PNVTs represent the vegetation type and characteristics that would occur when natural disturbance regimes and biological processes prevail. Ecological Response Unit (ERU) is equivalent to PNVT; ERU nomenclature has been updated.

Prescribed fire – A wildland fire originating from a planned ignition to meet specific objectives identified in a written and approved prescribed fire plan for which NEPA requirements (where applicable) have been met prior to ignition. See planned ignition.

Primitive recreation – Reliance on personal skills and nonmotorized and non-mechanized means to travel and camp in an area, rather than reliance on facilities or outside help.

Priority 6th level (subwatershed) HUC watershed – The designated watersheds (subwatersheds) where restoration activities will concentrate on the explicit goal of improving watershed condition.

Proper functioning condition (PFC) – Proper functioning condition (PFC) is a qualitative method for assessing the condition of riparian-wetland areas. The term PFC is used to describe both (1) the assessment process or tool and (2) a defined, on the ground condition of a riparian-wetland area:

- (1) The PFC tool is designed to assess if the physical elements (abiotic and biotic) are in working order relative to an area's capability and potential. When these physical elements are in working order, then channel characteristics develop that provide habitat for wildlife and other uses. Functionality comes first; then desired conditions are achieved.
- (2) A riparian-wetland area is considered to be in proper functioning condition when adequate vegetation, landform, or large woody debris is present to:
    - dissipate stream energy associated with high water flow, thereby reducing erosion and improving water quality;
    - filter sediment, capture bedload, and aid floodplain development;
    - improve floodwater retention and groundwater recharge;
    - develop root masses that stabilize stream banks against cutting action;
    - develop diverse ponding and channel characteristics to provide the habitat and the water depth, duration, and temperature necessary for fish production, waterfowl breeding, and other uses; and
    - support greater biological diversity (Bureau of Land Management, 1998).

Proposed Species – Any species of fish, wildlife, or plant that is proposed in the Federal Register to be listed under section 4 of the Endangered Species Act.

Range condition – The present state of vegetation of a range site in relation to the climax (potential natural) plant community for that site. It is an expression of the relative degree to which the kinds, proportions, and amounts of plants in a plant community resemble that of the climax plant community for the site (Forest Service 1999). Range condition as evaluated and ranked by the Forest Service, is an adjective expression of the status or health of the vegetation and soil relative to the combined potential to produce a sound and stable biotic community. Soundness and stability are evaluated relative to a standard that encompasses the composition, density, and vigor of the vegetation and physical characteristics of the soil. The adjectives that describe range condition are: excellent, good, fair, poor and very-poor (FSH 2209.21, Southwestern Region). According to Holechek et al. (1989), range condition is measured in degrees of departure from climax; excellent range condition would represent climax, and very-poor range condition would represent the greatest departure from climax.

Recreation opportunity spectrum (ROS) – A framework for defining the types of outdoor recreation opportunities the public might desire, and identifies that portion of the spectrum a given national forest area might be able to provide. The ROS map can be found in the plan set of documents. The broad classes are:

- **Primitive (P)** – Characterized by essentially unmodified natural environment. Interaction between users is very low and evidence of other users is minimal. Essentially free from evidence of human-induced restrictions and controls. Motorized use within the area is generally not permitted. Very high probability of experiencing solitude, closeness to nature, tranquility, self-reliance, and risk.
- **Semiprimitive Nonmotorized (SPNM)** – Characterized by a predominantly natural or natural appearing environment. Interaction between users is low, but there is often evidence of other users. The area is managed in such a way that minimum onsite controls and restrictions may be present but are subtle. Motorized use is generally not permitted. High probability of experiencing solitude, closeness to nature, tranquility, self-reliance, and risk.
- **Semiprimitive Motorized (SPM)** – Characterized by a predominantly natural or natural appearing environment. Concentration of users is low, but there is often evidence of other users. The area is managed in such a way that minimum onsite controls and restrictions may be present but are subtle. Motorized use is generally permitted. Moderate probability of experiencing solitude, closeness to nature, tranquility, self-reliance, and risk.
- **Roaded Natural (RN)** – Characterized by a predominantly natural appearing environment with moderate evidence of the sights and sounds of other humans. Such evidences usually harmonize with the natural environment. Interaction between users may be low to moderate but with evidence of other users prevalent. Resource modification and utilization practices are evident but harmonize with the natural environment. Conventional motorized use is provided for in construction standards and design of facilities. Opportunity to affiliate with other users in developed sites but with some chance for privacy.
- **Roaded Modified (RM)** – Characterized by substantially modified natural environment except for campsites. Roads and management activities may be strongly dominant. There is moderate evidence of other users on roads. Conventional motorized use is provided for in construction standards and design of facilities. Opportunity to get away from others but with easy access.
- **Rural (R)** – Characterized by substantially modified natural environment. Resource modification and utilization practices are to enhance specific recreation activities and to maintain vegetative cover and soil. Sights and sounds of humans are readily evident, and the interaction between users is often moderate to high. A considerable number of facilities are designed for use by a large number of people. Facilities are often provided for special activities. Moderate densities are provided far away from developed sites. Facilities for intensified motorized use and parking are available. Opportunity to observe and affiliate with other users is important, as is convenience of facilities.
- **Urban (U)** – Characterized by a substantially urbanized environment, although the background may have natural appearing elements. Resource modification and utilization practices are to enhance specific recreation activities. Vegetative cover is often exotic and manicured. Sights and sounds of humans onsite are predominant. Large numbers of users can be expected, both onsite and in nearby areas. Facilities for highly intensified motor use and parking are available with forms of mass transit often available to carry people throughout the site. Opportunity to observe and affiliate with other users is very important, as is convenience of facilities.

Redundancy – Multiple occurrences of the representative conditions across the landscape.

Reference conditions – Environmental conditions that infer ecological sustainability. Reference conditions are often represented by the historic range of variation (i.e., the characteristic range of variation, not the total range of variation) for a particular attribute, prior to Euro-American settlement and under the current climatic period. For some ecosystems, the historic range of variation reflects American Indian burning. Reference conditions may not necessarily represent desired conditions.

Reforestation – The natural or artificial reestablishment (restocking) of an area with forest trees.

Regulated – The technical (rather than legal or administrative) aspect of controlling forest stocking, periodic harvests, growth, and yields to meet management objectives including sustained yield. This control can be done either by area, volume of growing stock, or basal area or stand density index measures. An uneven-aged, regulated forest is one which has a balanced progression of three or more age/size classes, such that each younger/smaller class is advancing to replace the class above it on approximately the same acreage, until it is mature for harvest or other resource objectives. A regulated forest reaches sustained yield when the volume cut periodically equals the amount of net volume growth for that same period.

Repatriation – In the Native American Graves Protection and Repatriation Act (25 USC 3005), the term "repatriate" means to transfer physical custody of and legal interest in Native American cultural items to lineal descendants, culturally affiliated American Indian tribes, and Native Hawaiian organizations.

Research natural area – A physical or biological unit in which current natural conditions are maintained insofar as possible. These conditions are ordinarily achieved by allowing natural physical and biological processes to prevail without human intervention. Research natural areas are principally for non-manipulative research, observation, and study. They are designated to maintain a wide spectrum of high quality representative areas that represent the major forms of variability found in forest, shrubland, grassland, alpine, and natural situations that have scientific interest and importance that, in combination, form a national network of ecological areas for research, education, and maintenance of biological diversity.

Resiliency –The ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organization, and the capacity to adapt to stress and change.

Restoration – See ecological restoration.

Riparian area – Terrestrial ecosystems characterized by wet soils and plant species that are water loving and dependent on the water table or its capillary fringe zone (a zone in the soil just above the water table that remains saturated or almost saturated. Riparian areas make up the most biologically productive component of forest ecosystems providing unique wildlife habitat in the Southwest. Riparian areas also function to transport and filter water, soil and organic material from upslope to stream.). Examples of riparian areas on the forests include areas along streams, or around wetlands, lakes, ponds, springs and seeps, and include wet meadows, fens, bogs and floodplains.

Road decommissioning – Activities that result in the stabilization and restoration of unneeded roads to a more natural state (36 CFR § 212.1). It includes a range of activities from ripping and

seeding to full reclamation by restoring the original topography. Road decommissioning results in the removal of a National Forest System road from the forest transportation atlas.

Road removal – The elimination of unauthorized routes. It includes a range of activities from ripping and seeding to full reclamation by restoring the original topography.

Scale – The aerial extent of certain plan decisions are described at various scales:

- **Fine scale** is an area of about 10 acres or less at which the distribution of specific site characteristics such as individual tree species (single, grouped, or aggregates of groups) is described.
- **Mid-scale** is an area of 100 to 1,000 acres composed of assemblages of fine scale units that have similar biophysical conditions.
- **Landscape scale** is an assemblage of mid-scale units typically composed of variable elevations, slopes, aspects, soils, plant associations, and natural ecological processes. An area at this scale comprises multiple mid-scale units, most often 10 or more.
- **6th level HUC** watershed scale is a unit of the forest approximately comparable to a 6th level HUC (hydrologic unit code) watershed (approximately 5,000 to 80,000 acres).
- **4th to 5th level HUC** watershed scale is a unit of the forest approximately comparable to a 4th level HUC (hydrologic unit code) watershed (approximately 400,000 to 2,000,000 acres). A 4th level HUC watershed is an aggregation of multiple 5th level HUC watersheds. A 5th level HUC watershed scale is a unit of the forest approximately comparable to a 5th level HUC watershed (approximately 80,000 to 300,000 acres).

Scenic integrity – The state of naturalness or a measure of the degree to which a landscape is visually perceived to be "complete." The highest scenic integrity ratings are given to those landscapes that have little or no deviation from the landscape character valued by constituents for its aesthetic quality. Scenic integrity is the state of naturalness or, conversely, the state of disturbance created by human activities or alteration. Scenic integrity is measured in five levels:

- **Very high** (unaltered) – A scenic integrity level that generally provides for ecological change only.
- **High** (appears unaltered) – Human activities are not visually evident. In high scenic integrity areas, activities may only repeat attributes of form, line, color, and texture found in the existing landscape character.
- **Moderate** (slightly altered) – Landscapes where the valued landscape character "appears slightly altered." Noticeable deviations must remain visually subordinate to the landscape character being viewed.
- **Low** (moderately altered) – Human activities must remain visually subordinate to the attributes of the existing landscape character. Activities may repeat form, line, color, or texture common to these landscape characters, but changes in quality of size, number, intensity, direction, pattern, and so on, must remain visually subordinate to these landscape characters.
- **Very Low** (heavily altered) – Human activities of vegetative and landform alterations may dominate the original, natural landscape character but should appear as natural occurrences when viewed at background distances.

Seed cut – One step of an even-aged regeneration cutting method in which the healthiest, most desirable trees are left, and stand conditions are created for them to become good cone producers. The intention is to promote natural tree regeneration where needed.

Selection regeneration method – An uneven-aged method where individual trees or groups of trees of all size classes are removed, more or less uniformly throughout the stand, to promote growth of remaining trees and to provide space for regeneration. Includes individual tree selection and group selection methods.

Sense of place – The aesthetic, nostalgic, or spiritual effects of physical locations on humans based on personal, use oriented, or attachment oriented relationships between individuals and those locations. The meaning, values, and feelings that people associate with physical locations because of their experiences there.

Sensitive species – A sensitive plant or animal species for which population viability is a concern as evidenced by: (1) a significant or predicted downward trend in population numbers or density, or (2) a significant current or predicted downward trend in habitat capability that would reduce a species' existing distribution (FSM 2670.32). Sensitive species are designated by the regional forester and that status is periodically reviewed. Impacts to sensitive species from forest management and activities are analyzed in a biological evaluation.

Seral state – A particular plant and animal community developmental stage which is transitional between other stages along the continuum of succession or change. Changes in seral states can take place over time or very quickly and movement between states can be in either direction. Aspen is an example of a seral state that, without disturbance over time, will eventually be replaced by a subsequent seral state dominated by conifers.

Silvics – Knowledge of forest tree species differing needs for light, water, soil nutrients, growing space, and temperature ranges; it includes species adaptations and responses to various environmental factors such as fire, flood, extreme temperatures, wind, drought, insects, diseases, wildlife, and other tree species. The basis for silviculture.

Silviculture – The art and science of controlling the establishment, growth, composition, health, and quality of forests and woodlands using species silvics to meet the diverse needs and values of landowners and society on a sustainable basis. Under this definition, silvicultural treatments include all management activities that control the establishment, growth, composition, health, and quality of forested lands to achieve stated land management objectives. The use of prescribed fire on forested lands qualifies as a silvicultural treatment in the context of this definition.

Sinkholes – Large depressions in limestone geology; rimrock-lined depressions in basaltic geology may be considered sinks as well.

Slash – The residue (e.g., branches, bark) left on the ground after a management activity such as logging, or natural ecological process such as a storm or fire.

Snags – Standing dead or partially dead trees (snag topped), often missing many or all limbs and/or bark. Snags (generally 12 inches or larger) provide essential wildlife habitat for many species and are important for forest ecosystem function.

Soil and water conservation practices – Set of practices, which when applied during implementation of a project, protects soil and water quality to the level required by beneficial uses. These lead to the formation of site-specific BMPs during project planning.

Soil condition rating – A qualitative rating developed within the Southwestern Region of the Forest Service that provides an overall picture of soil condition vital in sustaining ecosystems. It is based on three soil functions: the ability of soil to resist erosion, infiltrate water, and recycle nutrients. There are four soil condition ratings:

- **Satisfactory** – soil function is being sustained and soil is functioning properly and normally.
- **Impaired** – the ability of the soil to function properly and normally has been reduced or there exists an increased vulnerability to degradation.
- **Unsatisfactory** – degradation of vital soil functions result in the inability of the soil to maintain resource values, sustain outputs, or recover from impacts.
- **Inherently unstable** – these soils are eroding faster than they are renewing themselves.

Soil productivity – The inherent capacity of the soil to support appropriate site-specific biological resource management objectives, which includes the growth of specified plants, plant communities, or a sequence of plant communities to support multiple land uses.

Special use authorization – A permit, term permit, temporary permit, lease, easement, or other written instrument that grants rights or privileges of occupancy and use subject to specified terms and conditions on National Forest System land.

Species diversity – Abundance of different species (both plant and animal) on the Apache-Sitgreaves NFs and adjoining lands; species richness. NFMA requires that land management plans provide for diversity of plant and animal communities.

Springs and seeps - Springs and seeps are groundwater-dependent ecosystems where groundwater discharges at the ground surface, often through complex subsurface flow paths (Stevens and Meretsky, 2008).

Stand – A contiguous group of trees generally uniform in age class distribution, composition, condition, and structure, and growing on a site of generally uniform quality, to be a distinguishable unit, such as mixed, pure, even-aged, and uneven-aged stands. A stand is the fundamental unit of silviculture reporting and record keeping.

Stray animal –

- " . . . livestock, bison or ratites whose owner is unknown or cannot be located, or any such animal whose owner is known but permits the animal to roam at large on the streets, alleys, roads, range or premises of another without permission." (Arizona Revised Statute: Title 3, Chapter 11, Article 7, 3-1401)
- Stray horses and burros are animals that do not meet the definition of a wild free-roaming horse in accordance with 16 USC 1332(b), 36 CFR 222.60(b)(13), and 36 CFR 222.63.

Structure – Structure includes both the vertical and horizontal dimensions of a vegetation type or plant community. The horizontal structure refers to spatial patterns of individual and groups of plants and openings, as well as plant size and species composition. The vertical component refers to the layers of vegetation between the forest floor and the top of the canopy. Each vegetation

type has its own structure. For example, forests have greater vertical structure than a grassland or woodland based on the height of the dominant species.

Suitable timberlands – Land to be managed for timber production on a regulated basis. Such lands are those which have been determined to meet the following criteria: (a) are available for timber production (i.e., not withdrawn for wilderness or other official designation by Congress, the Secretary of Agriculture, or Chief of the Forest Service); (b) are physically capable of producing crops of industrial wood without irreversible resource damage to soils productivity or watershed conditions; (c) adequate tree restocking within 5 years of final harvest is reasonably assured; (d) adequate information exists about responses to timber management activities; (e) timber management is cost efficient over the planning horizon in meeting forest objectives that include timber production; (f) timber production is consistent with meeting the management requirements and multiple use objectives specified in the forest plan or plan alternative; and (g) other management objectives do not limit timber production activities to the point where it is impossible to meet management requirements set forth in 36 CFR § 129.27 (per FSH 2409.13, WO Amendment 2409.13-92-1, O Code and Chapter 20).

Sustainability – Meeting the needs of the present generation without compromising the ability of future generations to meet their needs. Sustainability is composed of desirable social, economic, and ecological conditions or trends interacting at varying spatial and temporal scales embodying the principles of multiple use and sustained yield.

Temporary road or trail – A road or trail necessary for emergency operations or authorized by contract, permit, lease, or other written authorization that is not a forest road or trail and that is not included in a forest transportation atlas (36 CFR § 212.1).

Terrestrial ecosystem survey (TES) – Also called the terrestrial ecological unit inventory, the TES identifies ecological units for the Apache-Sitgreaves NFs that are distinct from each other in terms of their soil, vegetation, and climate components.

Thinning – An intermediate treatment made to reduce the stand density of trees primarily to improve growth, enhance forest health, recover potential mortality, emphasize desired tree species, and/or emphasize desired forest structure. It includes crown thinning (thinning from above, high thinning), free thinning, low thinning (thinning from below), selection thinning (dominant thinning), mechanical thinning (leaves trees in equally-spaced rows), and mechanized thinning (any spacing arrangement). Mechanized thinning should not be confused with mechanical thinning. As used in this plan “mechanized thinning” includes prescribed cuts made by both hand and/or mechanized equipment, as a distinction from prescribed thinning by use of wildland fire only. Traditional (cutting) prescribed thinning can be used with both even- and uneven-aged management systems. Thinning with prescribed fire can qualify as an intermediate treatment, but may not provide enough controlled tree selection to clearly fit in either management system.

Timber production – Purposefully growing, tending, harvesting, and regenerating regulated crops of trees to be cut into logs, bolts, or other round sections for industrial or consumer use. In addition, managing land to provide commercial timber products on a regulated basis with planned, scheduled entries. It does not include firewood or harvest from unsuitable lands. (FSM 1900)

Traditional cultural property (TCP) – Defined in National Register Bulletin 38 as properties associated "with cultural practices or beliefs of a living community that (a) are rooted in that community's history, and (b) are important in maintaining the continuing cultural identity of the community." TCPs can range from structures, mountains, and other landforms to plant gathering locations to communities. These areas are considered historic properties that may be eligible to the National Register of Historic Places.

Tree cutting – The cutting or removal of trees for wood fiber use and other multiple use purposes. Sometimes referred to as "timber harvest" or "thinning."

Tread Lightly!® – Outdoor ethics with a special focus on motorized and mechanized recreation. http://www.treadlightly.org

Unauthorized livestock – Any cattle, sheep, goat, hog, or equine not defined as a wild free-roaming horse or burro by 36 CFR § 222.20(b)(13), which is not authorized by permit (or Bill for Collection) to be upon the land on which the livestock is located and which is not related to use authorized by a grazing permit (livestock owned by other than a national forest grazing permit holder). Noncommercial pack and saddle stock used by recreationists, travelers, other forest visitors for occasional trips, as well as livestock to be trailed over an established driveway when there is no overnight stop on Forest Service administered land do not fall under this definition.

Unauthorized road or trail – A road or trail that is not a forest road or trail or a temporary road or trail and that is not included in a forest transportation atlas (36 CFR § 212.1). Sometimes referred to as a "user-created" road or trail.

Uncharacteristic wildfire – An increase in wildfire size, severity, and resistance to control compared to reference conditions which occurred historically. These fires result as a consequence of more continuous canopy cover, ladder fuels, and accumulated live and dead woody material. Uncharacteristic wildfires burn with more intensity; cause higher tree mortality; degrade watersheds; sterilize soils; and threaten adjacent communities, forest infrastructure, and wildlife habitat. See reference conditions

Uneven-aged forests – Forests that comprise three or more distinct age classes of trees, either inter-mixed or in small groups.

Uneven-aged management – The application of combined actions needed to simultaneously maintain continuous forest cover, recurring regeneration of desirable species, and the orderly growth and development of trees through a range of diameter or age classes to provide a sustained yield of forest products. Cutting is usually regulated by specifying the number or proportion of trees of particular sizes to retain within each area, thereby maintaining a planned distribution of size classes. Cutting methods that develop and maintain uneven-aged stands are single-tree selection and group selection.

Unplanned ignition – The initiation of a wildland fire by lightning or unauthorized and accidental human-caused fires. See wildfire.

Use of wildland fire - Management of either wildfire or prescribed fire to meet resource objectives specified in land management plans.

Values to be protected (values at risk) - Includes property; structures; physical improvements; natural and culture resources; community infrastructure; and economic, environmental, and social values.

Vigor – Relates to the relative robustness of a plant in comparison to other individuals of the same species. It is reflected primarily by the size of a plant (i.e., height, weight) and its parts in relation to its age and the environment in which it is growing.

Wild and scenic rivers – These rivers are free-flowing and have at least one outstandingly remarkable value. Eligible and suitable rivers are given a tentative classification of wild, scenic, or recreational. These rivers may be included in the National Wild and Scenic Rivers System.

- **Wild** – Those rivers or segments of rivers free of impoundments and generally inaccessible except by trail, with watersheds or shorelines essentially primitive, and waters unpolluted. These represent vestiges of primitive America.
- **Scenic** – Those rivers or segments of rivers free of impoundments, with shorelines or watersheds still largely primitive, and shorelines largely undeveloped but accessible in places by roads.
- **Recreational** – Those rivers or segments of rivers readily accessible by road or railroad, that may have some development along their shorelines, and that may have undergone some impoundment or diversion in the past.

Wild free-roaming horses and burros –

- " . . . all unbranded and unclaimed horses and burros on public lands of the United States." (16 USC 1332(b)).
- "Wild free-roaming horses and burros mean all unbranded and unclaimed horses and burros and their progeny that have used lands of the National Forest System on or after December 15, 1971, or do hereafter use these lands as all or part of their habitat, but does not include any horse or burro introduced onto the National Forest System on or after December 15, 1971, by accident, negligence, or willful disregard of private ownership. Unbranded, claimed horses and burros for which the claim is found to be erroneous, are also considered as wild and free-roaming if they meet the criteria above." (36 CFR 222.60(b)(13))
- "Horses and burros not within the definition in § 222.20(b)(13) [recodified as 36 CFR § 222.60(b)(13)] which are introduced onto Wild Horse and Burro Territories or ranges after December 15, 1971, by accident, negligence, or willful disregard of private ownership, and which do not become intermingled with wild free-roaming horses or burros shall be considered as unauthorized livestock and treated in accordance with provisions in 36 CFR 261.7 and 262.10." (36 CFR 222.63)

Wild Horse and Burro Territory – " . . . lands of the National Forest System which are identified by the Chief, Forest Service, as lands which were territorial habitat of wild free-roaming horses and/or burros at the time of the passage of the Act." (36 CFR 222.60(b)(15))

Wildfire – Unplanned ignition of a wildland fire (e.g., fires caused by lightning or unauthorized and accidental human-caused fires) and escaped prescribed fires. See unplanned ignition.

Wildfire hazard – A fuel complex, defined by volume, type condition, arrangement, and location, that determines the degree or ease of ignition and of resistance to control.

Wildland – An area in which development is essentially nonexistent, except for roads, railroads, power lines, and similar transportation facilities. Structures, if any, are widely scattered.

Wildland fire – A general term describing any non-structure fire that occurs in the vegetation and/or natural fuels. The two types of wildland fire are wildfires and prescribed fires. Other terms such as “fire-use fires,” “resource benefit fires,” or “suppression fires” are not used in this plan.

Wildland-urban interface (WUI) – Wildland-urban interface includes those areas of resident populations at imminent risk from wildfire, and human developments having special significance. These areas may include critical communications sites, municipal watersheds, high voltage transmission lines, church camps, scout camps, research facilities, and other structures that, if destroyed by fire, would result in hardship to communities. These areas encompass not only the sites themselves, but also the continuous slopes and fuels that lead directly to the sites, regardless of the distance involved. (FSM 5140.5, Southwestern Region supplement).

Wildling – A native plant growing uncultivated in the wild: specifically, the collection or transplant of such whole live plants.

Windthrow – Trees susceptible to wind damage (e.g., uprooting, toppling, bole breakage).

Woody biomass – The trees and woody plants, including limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or grassland environment, that are the byproducts of forest management used to produce bioenergy and the full range of bio-based products.

References

Arizona Department of Environmental Quality. (2003). Arizona State Implementation Plan to Maintain and Improve Air Quality. Phoenix, AZ.

Arizona Department of Environmental Quality. (2012). 2010 Status of Water Quality: Arizona's Integrated 305 (b) Assessment and 303(d) Listing Report. Phoenix, AZ.

Arizona Game and Fish Department. (2003). Crayfish. Phoenix, AZ. (pamphlet) 2 pp. [online] URL: http://www.azgfd.gov/pdfs/i_e/Crayfish_Brochure.pdf

Barkworth, M.E.; K.M. Capels; S. Long; and M.B. Piep (eds.). (2003). Flora of North America: North of Mexico, Vol. 25, Magnoliophyta: Commelinidae (in part): Poaceae, part 2. Oxford University Press, Inc. New York, NY. 911 pp.

Barkworth, M.E.; K.M. Capels; S. Long; L.K. Anderton; and M.B. Piep (eds.). (2007). Flora of North America: North of Mexico, Vol. 24, Magnoliophyta: Commelinidae (in part): Poaceae, part 1. Oxford University Press, Inc. New York, NY. 783 pp.

Benson, L.; and R.A. Darrow. (1981). Trees and shrubs of the southwestern deserts, 3rd edition. The University of Arizona Press. Tucson, AZ. 416 pp.

Bureau of Land Management, U.S. Department of the Interior. (1998). Riparian area management: A user guide to assessing proper functioning condition and the supporting science for lotic areas, Prichard, D.; Anderson, J.; Correll, C.; Fogg, J.; Gebhardt, K.; Krapf, R.; Leonard, S.; Mitchell, B.; and Staats, J. (wkgroup.). Tech. Ref. 1737–15, USDI Bureau of Land Management, Service Center. Denver, CO. BLM/RS/ST-98/001+1737. 134 pp.

Bureau of Land Management, U.S. Department of the Interior. (1999). Riparian area management: A user guide to assessing proper functioning condition and the supporting science for lentic areas, Prichard, D.; Berg, F.; Hagenbuck, W.; Krapf, R.; Leinard, R.; Leonard, S.; Manning, M.; Noble, C.; and Staats, J. (wkgroup.), Tech. Ref. 1737-16, USDI Bureau of Land Management, Service Center. Denver, CO. BLM/RS/ST-99/001+1737+REV03. 118 pp.

Bureau of Land Management, U.S. Department of the Interior, and Cooperative Extension Service, Forest Service, and Natural Resources Conservation Service, U.S. Department of Agriculture. (1999). Interagency Technical Reference 1734-3: Utilization Studies and Residual Measurements.

Correll, D.S.; and H.B. Correll. (1975). Aquatic and wetland plants of the Southwestern United States, Vols. 1 and 2. Stanford University Press. Stanford, CA. 1,777 pp.

Cronquist, A.; A.H. Holmgren; N.H. Holmgren; J.L. Reveal; and P.K. Holmgren. (1997). Intermountain flora: Vascular plants of the Intermountain West, U.S.A., Vol. 6, the Monocotyledons. The New York Botanical Gardens, Columbia University Press. New York, NY. 584 pp.

Elzinga, C.L.; D.W. Salzer; and J.W. Willoughby. (1998). Measuring and monitoring plant populations. BLM Tech. Ref. 1730–1, USDI Bureau of Land Management, Service Center. Denver, CO. BLM/RS/ST-98/005+1730. 477 pp.

Environmental Protection Agency (EPA). (1999). EPA Regional Haze Rule 40 CFR § 51. EPA Office of Air and Radiation, Technology Transfer Network, OAR Policy and Guidance Record.

Flora of North America. (2008). [online] URL: http://floranorthamerica.org/

Franklin, J.F.; and T.A. Spies. (1991). Ecological definitions of old-growth Douglas-fir Forests. Pp. 61–69 in *Wildlife and Vegetation of Unmanaged Douglas-fir Forests*. L.F. Ruggiero, K.B. Aubry, A.B. Carey, and M. Huff, tech. coords. USDA Forest Service Gen. Tech. Rep. PNW-GTR-285. Pacific Northwest Research Station. Portland, OR. 533 pp.

Forest Service, U.S. Department of Agriculture. (1999). Southwestern Region rangeland analysis and management training guide. Southwestern Region. Albuquerque, NM. 224 pp.

Forest Service. U.S. Department of Agriculture. (2001). USDA – Forest Service guide to noxious weed prevention practices. Version 1.0, Dated July 5, 2001. Northern Region, Missoula, MT. 25 pp.

Forest Service. U.S. Department of Agriculture. (2008a). Comprehensive Evaluation Report. Apache-Sitgreaves National Forests. Springerville, AZ.

Forest Service. U.S. Department of Agriculture. (2008b). Ecological Sustainability Report. Apache-Sitgreaves National Forests. Springerville, AZ.

Forest Service. U.S. Department of Agriculture. (2008c). Forest Plan Revision Resource Evaluations. Apache-Sitgreaves National Forests. Springerville, AZ.

Forest Service. U.S. Department of Agriculture. (2008d). Keeping it Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System. Gen. Tech. Rep. RMRS-GTR-212. Rocky Mountain Research Station. Fort Collins, CO.

Forest Service. U.S. Department of Agriculture. (2009a). Economic and Social Sustainability Assessment. Apache-Sitgreaves National Forests. Springerville, AZ.

Forest Service. U.S. Department of Agriculture. (2009b). Eligibility Report for the National Wild and Scenic River System. Apache-Sitgreaves National Forests. Springerville, AZ.

Forest Service. U.S. Department of Agriculture. (2010a). Comprehensive Evaluation Report Supplement to Meet Analysis of the Management Situation Requirements. Apache-Sitgreaves National Forests. Springerville, AZ.

Forest Service. U.S. Department of Agriculture. (2010b). Final Environmental Assessment for Blue River and KP Creek Wild and Scenic Suitability. Apache-Sitgreaves National Forests. Springerville, AZ.

Forest Service, U.S. Department of Agriculture. (2011). Watershed Condition Framework-A Framework for Assessing and Tracking Changes to Watershed Condition FS-977. Washington, DC. 32 pp.

Forest Service. U.S. Department of Agriculture. (2012a). Programmatic Environmental Impact Statement for the Land Management Plan. Apache-Sitgreaves National Forests. Springerville, AZ.

Forest Service. U.S. Department of Agriculture. (2012b). Wallow Fire Changed Condition Assessment. Apache-Sitgreaves National Forests. Springerville, AZ.

Forest Service, U.S. Department of Agriculture. (2012c). Groundwater-Dependent Ecosystems: Level II Inventory Field Guide. Gen. Tech. Report WO-86b. Washington, DC. 32 pp

Forest Service, U.S. Department of Agriculture, Arizona Game and Fish Department, Arizona Wildlife Federation, and Rocky Mountain Elk Foundation. (1990). Elk in Arizona's High Country: A Success Story of Cooperation on the Apache-Sitgreaves National Forests. (pamphlet) 2 pp.

Forest Service, U.S. Department of Agriculture and U.S. Department of Interior Bureau of Land Management, Bureau of Indian Affairs, Fish and Wildlife Service, and National Park Service (Forest Service and DOI). (2009). Guidance for Implementation of Federal Wildland Fire Management Policy. [online] URL: http://www.nifc.gov/policies/policies_documents/GIFWFMP.pdf.

Gould, F.W. (1977). Grasses of the southwestern United States. The University of Arizona Press. Tucson, AZ. 352 pp.

Helms, J.A. (ed.). (1998). The Dictionary of Forestry. The Society of American Foresters. pp. 1-224.

Hermann, F.J. (ed.). (1970). Manual of the *Carices* of the Rocky Mountains and Colorado Basin, Agriculture Handbook No. 374. USDA Forest Service, U.S. Government Printing Office. Washington, DC. 397 pp.

Hermann, F.J. (ed.). (1975). Manual of the rushes (*Juncus* spp.) of the Rocky Mountains and Colorado Basin. USDA Forest Service, General Technical Report GTR RMRS-18. Rocky Mountain Forest and Range Experiment Station. Fort Collins, CO. 107 pp.

Hickman, J.C. (ed.). (1993). The Jepson manual: Higher plants of California. University of California Press. Berkeley, CA. 1,400 pp.

Hitchcock, A.S.; and A. Chase. (1971). Manual of the grasses of the United States, 2nd edition, Vols. 1 and 2. Dover Publications, Inc. New York, NY. 1,051 pp.

Hurd, E.G.; N.L. Shaw; J. Mastrogiuseppe; L.C. Smithman; and S. Goodrich. (1998). Field guide to Intermountain sedges. USDA Forest Service, General Technical Report GTR-RMRS-10. Rocky Mountain Research Station. Ogden, UT. 282 pp.

Invasive.org. Center for Invasive Species and Ecosystem Health. [online] URL: http://www.invasive.org

Kaufmann, M.R.; D. Binkley; P.Z. Fulé; M. Johnson; S.L. Stephens; and T.W. Swetnam. (2007). Defining old growth for fire-adapted forests of the western United States. Ecology and Society 12(2): 15. [online] URL: http://www.ecologyandsociety.org/vol12/iss2/art15/.

Küchler, A.W. (1964). Potential natural vegetation of the conterminous United States. American Geographical Society Special Publication No. 36. New York, NY. 116 pp. plus map.

Laing, L.; N. Ambos; T. Subirge; C. McDonald; C. Nelson; and W. Robbie. (1987). Terrestrial Ecosystem Survey for the Apache-Sitgreaves National Forests. Southwestern Region, Albuquerque, NM. 453 pp.

Martin, W.C.; and C.R. Hutchins. (1980). A flora of New Mexico, Vols. 1 and 2. A.R. Gantner Verlag K.G., FL-9490 Valduz, Strauss & Cramer GmbH, 6945 Hirschberg, Germany. 2,591 pp.

McDougall, W.B. (1973). Seed plants of northern Arizona. The Museum of Northern Arizona, Flagstaff, AZ. 594 pp.

Natural Resource Conservation Service, U.S. Department of Agriculture. (2003). National range and pasture handbook, 1st revision. Grazing Lands Technology Institute, Washington DC. 521 pp. [online] URL: http://www.nrcs.usda.gov/wps/portal/nrcs/detail/national/landuse/crops/?cid=stelprdb1043084

Oliver, C.D.; and B.C. Larson. (1996). Forest Stand Dynamics, Update Edition. John Wiley & Sons. New York, NY.

Purdue, J.R.; J.R. Heffelfinger; and K.E. Nicolls. (2002, January/February). Is Merriam's elk really extinct? *Arizona Wildlife Views*. pp. 6-10.

Reynolds, R.T.; A.J. Sánchez Meador; J.A Youtz; T. Nicolet; M.S. Matonis; P.L. Jackson; D.G. DeLorenzo; and A.D. Graves (2013). Restoring composition and structure in Southwestern frequent-fire forests: A science-based framework for improving ecosystem resiliency. Gen. Tech. Rep. RMRS-GTR-310. USDA Forest Service, Rocky Mountain Research Station. Fort Collins, CO. 76 pp.

Ruyle, G.B.; and D.J. Young. (1997). Arizona range grasses. Cooperative Extension, College of Agriculture, The University of Arizona. Tucson, AZ. 152 pp.

Smith, L.; G. Ruyle; J. Dyess; W. Meyer; S. Baker; C.B. Lane; S.M. Williams; J.L. Maynard; D. Bell; D. Stewart; and A. Coulloudon. (2012). Guide to rangeland monitoring and assessment. Arizona Grazing Lands Conservation Association. 196 pp.

Society for Range Management. (1998). A glossary of terms used in range management. Society for Range Management. Denver, CO. pp. 20.

Springer, J.D.; M.L. Daniels; and M. Nazaire. (2009). Field guide to forest and mountain plants of northern Arizona. Ecological Restoration Institute, Northern Arizona University. Flagstaff, AZ. 649 pp.

Stevens, L.E. Meretsky, V.J. (2008). Springs ecosystem ecology and conservation, In, Stevens, L.E.; Meretsky, V.J. eds. Aridland springs in North America: ecology and conservation, Tucson, AA: University of Arizona Press. pp 3-10.

Stynes, D.J.; and E.M. White. (2005). Spending Profiles of National Forest Visitors, NVUM Four Year Report. Michigan State University. East Lansing, MI. [online] URL: http://www.fs.fed.us/recreation/programs/nvum/NVUM4YrSpending.pdf

Thomas, J.W.; and D.E. Toweill. (1982). Elk of North America: Ecology and Management. Wildlife Management Institute in cooperation with U.S. Forest Service. pp. 23-24.

Vine, R.A. (1960). Trees, shrubs, and woody vines of the Southwest. University of Texas Press. Austin, TX. 1,104 pp.

Welsh, S.L.; N.D. Atwood; L.C. Higgins; and S. Goodrich. (1997). A Utah flora. Great Basin Naturalist Memoirs, No. 9. Brigham Young University, Provo, UT. 894 pp.

Appendix A. Climate Change Trends and Apache-Sitgreaves NFs Land Management Planning

Overview and Background

Climate scientists agree that the Earth is undergoing a warming trend, and that human-caused elevations in atmospheric concentrations of carbon dioxide (CO_2) and other greenhouse gases (GHGs) are among the causes of global temperature increases. The observed concentrations of these greenhouse gases are projected to increase. Climate change may intensify the risk of ecosystem change for terrestrial and aquatic systems, affecting ecosystem structure, function, and productivity.

This section contains a description of the climate patterns and trends in the Southwestern United States followed by a description of how current climate models and predictions may generally affect those climate patterns in the near future. Then, a short, land management plan revision oriented synthesis of climate change literature follows. This synthesis focuses on how climate change might be currently influencing—and may impact in the future—ecological and socioeconomic systems. The intent of the review is to examine those areas of climate change research that may have an impact on how the Apache-Sitgreaves NFs is managed. Specifically, this section summarizes current and future climate trends at the regional (American Southwest) and, if possible, the forests level. Possible effects of climate change on ecosystems are discussed regarding water abundance and quality, biological diversity and wildlife species, economic and social conditions in the Southwest, and a description of limitations and uncertainties inherent in projected future climate scenarios. Finally, this document discusses possible management issues that should be considered during land management planning.

Climate in the American Southwest and the Apache-Sitgreaves NFs

What is Climate?

Climate may be defined as the "average weather," or more rigorously, as the statistical description of weather in terms of the mean and variability of relevant quantities (e.g., temperature, precipitation, wind) over a period ranging from months to thousands or millions of years. The standard period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the statistical description of the state or condition of the climate system[1]. In contrast, weather describes the daily conditions (individual storms) or conditions over several days (e.g., a week of record-breaking temperatures) to those lasting less than 2 weeks[2]. Natural climate variability refers to variations due to natural internal processes (internal variability) in the

[1] According to the World Meteorological Organization, the climate system is a highly complex arrangement consisting of five major components: the atmosphere, hydrosphere, cryosphere, and land surface and biosphere, and the interactions between them. The climate system evolves in time under the influence of its own internal dynamics and because of external forcings such as volcanic eruptions and solar variations, and human-induced influences such as the changing composition of atmosphere and land use changes.

[2] The glossary of climate terms used in this report is drawn from "A Glossary of Terms" used in the "Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report" (IPCC, 2007).

climate system or natural external forcing (external variability), in the mean state and other statistics of the climate on all spatial and temporal scales beyond that of individual weather events (IPCC, 2007). Climate and climate variability are determined by the amount of incoming solar radiation, chemical composition and dynamics of the atmosphere, and surface characteristics of the Earth. The circulation of the atmosphere and oceans influences the transfer of heat and moisture around the planet and, thus, strongly influences climate patterns and their variability in space and time. Much of the current climate change literature states that human activities, such as fossil fuel burning, industrial activities, changes in land use, animal husbandry, and fertilized and irrigated agriculture, lead to increases in GHGs, including carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). These increased GHGs contribute to the greenhouse effect and cause the surface temperature of the Earth to increase. Global atmospheric concentrations of CO_2, CH_4, and N_2O have increased markedly because of human activities since 1750, and now far exceed preindustrial levels (IPCC, 2007).

The climate of the Southwest U.S. is often referred to as dry and hot; however, it is very complex. While low deserts of the Southwest experience heat and drying winds in the early summer, forested mountain areas and plateaus may experience cold and drifting snow during winter. Climate variability is the norm within this region, as temperature and precipitation fluctuate on time scales ranging from seasons to centuries. Monsoon thunderstorms in July and August are often accompanied by flash flooding. From fall to spring, the weather can be warm with clear skies. The Southwest also experiences periods of short and long term drought. Indeed, severe regional floods or droughts have affected both indigenous and modern civilizations on time scales ranging from single growing seasons to multiple years, even decades (Hughes et al., 2002).

To a large degree, a quasi-permanent subtropical high-pressure ridge over the Southwest leads to the characteristically low annual precipitation, clear skies, and year-round warm weather over much of the region. This high-pressure ridge is created through Hadley circulation[3]. Where the descending branch of Hadley circulation comes down, it tends to create a zone of atmospheric high pressure that makes it difficult for clouds to form. Much of the Southwest U.S. lies in the subtropical zone, where warm, dry air is flowing back down to Earth following its rain-inducing rise in the tropics. Descending air in the subtropics relates to an ongoing global pattern known as Hadley circulation.

In addition, the Southwest is located between the mid-latitude and subtropical atmospheric circulation regimes. This positioning, relative to shifts in these atmospheric patterns, is the main reason for the region's climatic variability. El Niño (also known as the El Niño Southern Oscillation or ENSO) is an increase in sea surface temperature of the eastern equatorial Pacific Ocean with an associated shift of the active center of atmospheric convection from the western to the central equatorial Pacific. ENSO has a well-developed teleconnection[4] with the Southwest, usually resulting in wet winters. La Niña, the opposite oceanic case of El Niño, usually results in dry winters for the Southwest. Another important oceanic influence on winter climate of the

[3] Hadley circulation is a flow pattern that dominates the tropical atmosphere, beginning with warm, moist air rising near the equator, poleward movement 6 to 9 miles above the surface, descending motion in the subtropics, and equatorward movement near the surface. This circulation is intimately related to the trade winds, tropical rainbelts, subtropical deserts, and jet streams.

[4] Teleconnections: Atmospheric interactions between widely separated regions that have been identified through statistical correlations (in space and time). For example, the El Niño teleconnection with the southwestern U.S. involves large scale changes in climatic conditions that are linked to increased winter rainfall.

Southwest is a feature called the Pacific Decadal Oscillation (PDO), which has been defined as temporal variation in sea surface temperatures for most of the northern Pacific Ocean. The major feature that sets the climate of the Southwest apart from the rest of the U.S. is the North American Monsoon which, in the U.S., is most noticeable in Arizona and New Mexico. Up to 50 percent of the annual rainfall of Arizona and New Mexico occurs as monsoonal storms from July through September (Hughes et al., 2002).

In summary, while many factors influence climate in the Southwest during a particular year or season, the region's overall climate is defined by predictable weather patterns that occur across the years and decades to define the region's climate. The region's overall aridity relates to a global circulation pattern known as Hadley circulation, which creates a semi-permanent high-pressure zone over the Southwest. Relatively high temperatures with dynamic daily swings define this geographic region. Mountains and other differences in elevation affect local climate patterns. The North American Monsoon works to bring moisture from the tropics into the region during the summer months.

Future Climate of the Southwest and the Apache-Sitgreaves NFs

Currently, there appears to be broad agreement among climate modelers that the Southwest U.S. is experiencing a drying trend that would continue well into the latter part of the 21st century (IPCC, 2007; Seager et al., 2007). While the ensemble[5] scenario used by Seager et al. (2007) included two models with predictions of increased precipitation, the researchers concluded that the overall balance between precipitation and evaporation would still likely result in an overall decrease in available moisture. Regional drying and warming trends have occurred twice during the 20th century (1930s Dust Bowl and the 1950s Southwest Drought) and were severe during what is known as the Medieval Climate Anomaly, an interval of warm, dry conditions with regional variability from A.D. 900 to 1350 (Hughes and Diaz, 2008; Herweijer et al., 2007). The current drought conditions may very well become the new climatology of the American Southwest, including the Apache-Sitgreaves NFs, within a timeframe of years to decades. According to recent multi-model ensemble scenarios, the slight warming trend observed in the last 100 years may continue, with the greatest warming to occur during winter. These climate models depict temperatures rising approximately 5 to 8 degrees Fahrenheit (F) by the end of the century (IPCC, 2007). This trend would increase pressures on the region's already limited water supplies, as well as increase energy demand, alter fire regimes and ecosystems, create risks for human health, and affect agriculture (Sprigg, 2000).

The number of extremely hot days is also projected to rise during the 21st century. By the end of the century, parts of the Southwest, including the Apache-Sitgreaves NFs, are projected to face summer heat waves lasting 2 weeks longer than have been occurring in recent decades. Some climate model interpretations also suggest a fivefold increase in unusually hot days by the end of the century, compared to 1961 to 1985. In effect, the high temperatures that formerly occurred on only the hottest 5 percent of days could become the norm for a quarter of the year—100 days or more—in much of the Southwest (IPCC, 2007).

[5] Multimodel ensembles: Researchers have found that the average of numerous available climate models—sometimes called the ensemble mean—almost always weigh in with more accuracy than any one model. This technique often uses 18 to 20 different coupled global circulation models and combines the output from each to produce and ensemble output (CCSP, 2008c).

Observations based on measurements from weather stations indicate that the temperature rise projected for the future is similar to the rate of increase much of the Southwest has already registered in recent decades, particularly since the mid-1970s. Since 1976, the average annual temperature increased by 2.5 degrees F in Arizona and 1.8 degrees F in New Mexico. The recent temperature increase is unusual, even in the context of records compiled from tree rings and other natural temperature archives dating back more than 1,200 years for the northern hemisphere (Trouet et al., 2009; Hughes and Diaz 2008; Herweijer et al., 2007; Meko et al., 2007).

Warmer winter temperatures in the Southwest have serious implications for snow cover, an important natural reservoir of water in the West. In a study conducted on two watersheds in central Arizona (one watershed partially located on the Apache-Sitgreaves NFs), Svoma (2009) found that between water years 1934 and 2007, average snowpack elevation levels have increased with a decrease in snow amounts. In his study, he directly correlated this with increasing temperatures. Shorter winters and less snowpack also affect the timing of natural cycles such as plant dormancy and blooming and peak river flows. Throughout the West, the number of days in the frost-free season, which varies by location, has been increasing more rapidly than in the East (Lenart, 2007). Summer temperatures have also climbed, especially since the mid-1970s. Maximum temperatures regularly reach above 100 degrees F daily for weeks on end in many southwestern cities (Lenart, 2007). The temperature rise alone has some predictable effects on aridity in the region. For instance, higher temperatures increase evaporation rates. Higher temperatures and a drier landscape increase wildfire hazard and put extra stress on ecosystems (Lenart, 2007).

Precipitation changes remain much more difficult to predict than temperature, because precipitation is more variable and operates on a smaller scale. Predicting future precipitation is difficult in the Southwest, due to added complexities such as topography and monsoonal timing. When comparing climate model simulations to what actually occurred, researchers found the results roughly matched 50 to 60 percent of the time for precipitation. This compares to about 95 percent of the time for temperature (Lenart, 2007).

Precipitation is projected to decline by 5 percent by 2100 for much of Arizona and New Mexico, based on modeling results from an ensemble of 18 general circulation models. A 10 percent decrease could occur for the southern half of Arizona; while northeastern New Mexico is projected to remain roughly stable, based on the same estimates. Such a precipitation decrease could have a more serious impact than the numbers suggest. The decrease of water draining into rivers and reservoirs typically can be double or triple the proportional reductions in rainfall amounts, especially when combined with higher temperatures (Christensen and Lettenmaier, 2006).

In another study, researchers using a multi-model ensemble of 19 models projected an increase in aridity for the Southwest. Their study defined the Southwest as the land area stretching from east to west, from Houston to San Francisco and north to south from Denver to Monterrey, Mexico; this area includes the Apache-Sitgreaves NFs. Only 2 of the 19 climate models evaluated suggested a potential decrease in aridity for the southwestern quadrant of the country (Seager et al., 2007).

Snowpack measurements suggest that rising temperatures are melting winter snow progressively earlier in the year, delivering water to reservoirs and water users in greater quantities earlier in the spring season. Historically, snowmelt has occurred at the same time communities ramp up their

water consumption, which has drained reservoirs as they fill. When streamflows rise earlier in the year, reservoirs fill more quickly. Earlier future streamflows would likely increase the chance that spikes in river flows occur when the reservoirs are at full capacity, increasing the probability of flash floods (Guido, 2008).

Average air temperatures are rising, and it is likely that continued warming would accentuate the temperature difference between the Southwest and the tropical Pacific Ocean, enhancing the strength of the westerly winds that carry moist air from the tropics into the Southwest during the monsoon. This scenario may increase the monsoon's intensity, duration, or both, in which case, floods would occur with greater frequency (Guido, 2008).

While the region is expected to dry out, it is also likely to see larger, more destructive flooding. Along with storms in general, hurricanes and other tropical cyclones are projected to become more intense. Arizona and New Mexico typically receive 10 percent or more of their annual precipitation from storms that begin as tropical cyclones in the Pacific Ocean. In fact, some of the largest floods in the Southwest have occurred when a remnant tropical storm hit a frontal storm from the north or northwest, providing energy to intensify a remnant tropical storm (Guido, 2008).

In summary, based on multi-model ensemble climate models, by the end of the 21st century the Southwest is likely to experience the following conditions: temperature increases of 5 to 8 degrees F; an increase in the number of extremely hot days, with summer heat waves lasting 2 weeks or more, accompanied by warmer winters with a reduced snowpack, and a later monsoonal season; a 5 percent drop in precipitation throughout most of Arizona, including the Apache-Sitgreaves NFs, and possibly a 10 percent drop in southern Arizona; and an increase in extreme flood events following an overall increase in tropical storms.

Discussion

The state of knowledge needed to address climate change at the Apache-Sitgreaves NFs scale is still evolving. Because none of the current climate models, including multi-model ensembles, adequately resolve important topographic variations (e.g., mountain ranges versus valleys) and occurrences such as ENSO (El Niño) or the North American Monsoon, their results are imprecise and the subject of continuing research. However, these models do reproduce much of the underlying features of the Earth's climate, and their basic structure has been proven under countless experiments and forecasts of the weather systems from which climate is usually described. Therefore, these models remain a credible means of estimating potential future climate scenarios. Most global climate models are not yet precise enough to apply to land management at the ecoregional or Apache-Sitgreaves NFs scale. This limits, to some degree, regional and Apache-Sitgreaves NFs specific analysis of potential effects from climate change. Additionally, industrial society during the past 200 years has likely placed unprecedented pressures on ecosystems, increasing the unpredictable nature of future environmental change (Millar et al., 2007).

Improvement in regional-level models has increased with refinement of global climate modeling techniques. As climate model resolution increased to about 4,000 square miles per grid square, regional models may eventually be considered reliable at resolutions of about 350 square miles, nearly double the area of Albuquerque, New Mexico (Lenart, 2008). These model improvements also may provide researchers the information they need to downscale results to the local level of

national forests. Research efforts in this area have been successful in capturing fine scale details of historical climate, suggesting that regional methods can add value for assessments of the impacts of climate change projections (Maurer and Hidalgo, 2008). Researchers at The Nature Conservancy are currently downscaling multi-model ensemble climate projections to spatial resolutions between roughly ½ and 7½ miles (Enquist and Gori, 2008). In another effort, scientists used statistical downscaling of multi-model ensemble to consider how Colorado River streamflow might change with climate (Christensen and Lettenmaier, 2006). In the future, this same approach could be applied to headwater streams on the Apache-Sitgreaves NFs (e.g., Blue River, Black River).

Paleoenvironmental studies of changing climate in the Southwest may provide a limited historical ecological context for ecosystem variability and climate change. Such studies can provide a limited range of knowledge about past climate change, strengthening or weakening El Niño or La Niña events, patterns of precipitation, drought severity, and changes in vegetation patterns (Swetnam and Betancourt, 1997; Swetnam et al., 1999). A recurrent trend in the literature suggests that predicting the future effects of climate change and subsequent challenges to land management in the Southwest remains inexact and would require a combination of approaches.

In summary, climate modeling is a developing science. Newer multi-model ensembles are "better than the sum of their parts" and are used increasingly for projecting climate change in the Southwest. Downscaling techniques, including statistical downscaling, dynamical downscaling, and sensitivity analysis, are improving. Regional modeling, which incorporates jet stream activity, tropical storm and monsoon tracking, and regional elevation effects, has a high potential to improve localized climate projections. However, this general regional-level modeling still relates to the Apache-Sitgreaves NFs.

Southwestern Climate Change and Apache-Sitgreaves NFs Ecosystems

Water and Climate Change

Changes in water distribution, timing of precipitation, availability, storage, watershed management, and human water uses may present some of the most important challenges of climate change and national forest management in the Southwest. Terrestrial and aquatic ecosystems and all human socioeconomic systems in the Southwest depend on water. In this section, the stage is set for the review of climate change by briefly discussing water in the Southwest, its overall importance to ecological and socioeconomic systems, and the possible impacts to this resource by potential changes in climate.

The prospect of future droughts becoming more severe because of global warming is a significant concern, especially because the Southwest continues to lead the Nation in population growth. Recent warming in some areas of the Southwest is occurring at a rate among the most rapid in the Nation (Seager et al., 2007) and is significantly higher than the global average in some areas. This is driving declines in spring snowpack and river flows. Further water cycle changes are projected which, when combined with increasing temperatures, signal a serious water supply challenge in the decades and centuries ahead. Water supplies are projected to become increasingly scarce, demanding tradeoffs among competing uses, and potentially leading to conflict.

Climate change, with both wet periods and droughts, has been a part of Southwestern climate for millennia. The droughts of the last 110 years pale in comparison to some of the decades-long "megadroughts" that the region experienced over the last 2,000 years (Seager et al., 2008). During the closing decades of the 1500s, for example, major droughts gripped areas of the Southwest. As of 2009, much of the Southwest remains in a drought that began about 1998, with 2002, the driest water year on record for many parts of Arizona[6] (McPhee et al., 2004), including the Apache-Sitgreaves NFs. This event is the most severe western drought of the last 110 years and is exacerbated by record warming. Projections for this century point to an increasing probability of regional drought, made more probable by warming temperatures. The most likely future for the Southwest is a substantially drier one. Combined with the historical record of severe droughts and the current uncertainty regarding the exact causes and drivers of these past events, the Southwest must be prepared for droughts that could result from multiple causes. The combined effects of natural climate variability and human-induced climate change could result in a challenging combination of water shortages for the region (Karl et al., 2009).

Development in the Southwest has been dependent upon technology to deliver water resources. Most snowpack and upland reservoir locations are on national forests in the Southwest (Smith et al., 2001; State of New Mexico, 2005). There are an estimated 3,771 surface acres of perennial lakes and ponds within the Apache-Sitgreaves NFs (Forest Service, 2008). The Apache-Sitgreaves NFs also contain many of the headwater streams in the Little Colorado, Salt, and Upper Gila River Basins. The Apache-Sitgreaves NFs receive a large portion of Arizona's annual snowpack. Current estimated water yields from the Apache-Sitgreaves NFs are roughly 384,650 acre-feet per year (Forest Service, 2008), the majority going to the greater Phoenix metropolitan area. Some studies predict water shortages and lack of storage capabilities to meet seasonally changing river flows and transfers of water from agriculture to urban uses as critical climate-related impacts to water availability (Barnett et al., 2008).

While agriculture remains the greatest water user in the Southwest, this use has decreased as Arizona's and New Mexico's booming populations demand more water for municipal and other uses and irrigation technologies improve; this ongoing trend could affect future agricultural uses. Without upland reservoirs and watersheds important to Arizona's largest metropolitan center located on the Apache-Sitgreaves NFs, alternative water sources, water delivery systems, and infrastructure support for agriculture would need to be developed (Lenart, 2007).

Extreme precipitation events, occurring after extended drought, may increase the number and severity of flash floods and accelerate soil erosion. The timing and extent of storm-related precipitation would play a key role in determining the degree to which people and the environment are affected (Swetnam and Betancourt, 1997; Swetnam et al., 1999; Lenart, 2007). In a drought of the magnitude of the worst 1-year drought on record, water demand may exceed supply by 68 percent. According to National Weather Service data from the last 110 years, portions of the Apache-Sitgreaves NFs experienced below average precipitation 1 year out of every 2 and drought[7] 1 year out of every 6. In a 5-year scenario modeled after the worst drought in the historical record, water demand in Arizona could exceed supply by 67 percent; in a 10-year scenario, demand may exceed supply by 59 percent (Lenart, 2007). In the Southwest, intense

[6] Drought impacts in 2002 included extensive wildfires, water supply emergencies, vegetation and wildlife mortality, and economic losses in the ranching, agriculture, and tourism sectors.

[7] The Society for Range Management defines drought as 75 percent or less of the average yearly rainfall.

debate would likely continue over water allocation. Add a highly variable climate over time and at a large, landscape scale; the situation becomes even more conflict prone (Lenart, 2007).

In the realm of human health, a sequence of rain-drought-rain can trigger outbreaks of Hantavirus. Also there is evidence linking unusually wet seasons with an increase in reported cases of valley fever. In both instances, the distribution of precipitation over time and space are important factors.

The flooding potential is very likely to increase because of earlier and more rapid snowpack melting, with more intense precipitation events. Even if total precipitation increases substantially, snowpack would likely be reduced because of higher overall temperatures. However, it is possible that more precipitation would create additional water supplies, reduce demand, and ease competition among uses (Joyce et al., 2001; Smith, et al., 2001).

In contrast, a drier climate is very likely to decrease water supplies and increase demand for uses such as agriculture, recreation, aquatic habitat, and power, thus increasing competition for decreasing supplies (Joyce et al., 2001). Overall, these trends would increase pressures on the already limited water supplies in the Southwest, increase energy demand, alter fire regimes and ecosystems, create risks for human health, and affect agriculture (Swetnam and Betancourt, 1997; Sprigg et al., 2000).

Climate Change and Potential Ecosystem Impacts on the Apache-Sitgreaves NFs

Natural ecosystems are regulated by climate, which is, to some degree, determined by natural ecosystems. Long term or short term climate variability may cause shifts in the structure, composition, and functioning of ecosystems, particularly in the fragile boundaries of the semiarid regions. These areas already contain plants, insects, and animals highly specialized and adapted to the landscape. A changing climate of wetter, warmer winters and overall temperature increases would alter their range, type, and number throughout the Southwest. Responding differently to shifts in climate, the somewhat tenuous balance among ecosystem components would also change. As phenology is altered, the overall effects between interacting species are difficult to predict, particularly given the rate of climate change and the ability of symbionts to adapt. As the health of the ecosystem is a function of water availability, temperature, carbon dioxide, and many other factors, it is difficult to determine accurately the extent, type, and magnitude of ecosystem change under future climate scenarios. Yet, should vegetation cover and moisture exchanging properties of the land change, important local and regional climate characteristics such as albedo,[8] humidity, wind, and temperature would also change with potential compounding effects to vegetation (Sprigg et al., 2000).

Current research shows that climate is much more variable than is commonly understood and that this is expressed in nested temporal and spatial scales. Millar et al. (2007) provide a summation of natural climatic variables and their implications for forest managers. These are three key points from that research which should be considered in Apache-Sitgreaves NFs management strategies:

[8] Albedo is the reflectance of a surface. Absorbed solar radiation warms the Earth's surface, whereas, reflected radiation does not. Albedo is one component of this energy feedback. Different land covers have varied albedo. Thus, land use change can influence albedo and whether a land surface has a warming or cooling effect. For example, snow has a very high albedo and, thus, has a cooling effect (negative feedback). Melting of snow or coverage of snow with vegetation or black carbon (from air pollution) results in a lower surface albedo and has a warming effect (positive feedback) (IPCC, 2007).

1. The past record clearly shows that ecological conditions change constantly in response to climate. Plant and animal species would shift even in the absence of human influence (Millar et al., 2007).
2. Wet/dry oscillations associated with ocean-atmosphere patterns have driven regional and continental scale fire patterns for centuries. These patterns provide a basis for fire forecasting tools (Westerling et al., 2006).
3. Species ranges and populations are expected to be highly unstable as the climate shifts (Millar et al., 2007).

Climate may influence the distribution and abundance of plant and animal species through changes in resource availability, reproduction, and survivorship. The potential ecological implications of climate change trends in the Southwest indicate the following:

- More extreme natural ecological process events, including wildfires, intense rain, flash foods, and wind events (Swetnam et al., 1999).
- Greater vulnerability to invasive species, including insects, plants, fungi, and vertebrates (Joyce et al., 2006).
- Long term shifts in vegetation patterns (Westerling et al., 2006; Millar et al., 2007).
- Cold-tolerant vegetation moving upslope or disappearing in some areas; migration of some plant species to the more northern portions of their existing range (Clark, 1998).
- Potential decreases in overall forest productivity due to reduced precipitation (Forest Service, 2005).
- Shifts in the timing of snowmelt (already observed) in the American West, which, along with increases in summer temperatures, have serious implications for the survival of fish species and may challenge efforts to reintroduce species into their historic range (Joyce et al., 2006; Millar et al., 2007).
- Effects on biological diversity, pressure on wildlife populations, distribution, viability, movement and migration patterns because of increasing temperatures, water shortages, and changing ecological conditions.
- Effects on phenology and changes in the dates of flowering and associated pollination and food-chain disruptions (Guido, 2008).

In summary, expected changes to Southwest and Apache-Sitgreaves NFs ecosystems due to climate change include the following: projected decreases in precipitation, including reduced snowpack and overall water availability; increased risk from wildfire, insects and disease, and invasive species; and potential decreases in ecosystem productivity from water limitations and increased temperature. Potential impacts to riparian, wetland, and aquatic habitats and the species that depend on them are additional concerns.

Vegetation Changes

A warmer climate in the Southwest is expected to affect ecosystems by altering the biotic and abiotic stresses that influence and affect the vigor of ecosystems, leading to increased extent and severity of disturbances on the Apache-Sitgreaves NFs. As an example, the results of modeling five different climate scenarios by Ironside et al. (2010) showed only the San Francisco Peaks and the highest elevations of the Apache-Sitgreaves NFs having the only suitable climate for ponderosa pine (*Pinus ponderosa*) sustainability in Arizona for the 21st century. Decreasing water

availability and higher temperatures would accelerate the stresses (i.e., multiyear drought, insects, fire) experienced in forests, woodlands, grasslands, chaparral, and riparian communities. In concert, these stressors may have significant effects on growth, regeneration, long term distribution, abundance of forest species, and carbon sequestration.

Many Apache-Sitgreaves NFs ecosystems currently contain water-limited vegetation (e.g., semi-desert grassland, Madrean pine-oak woodland, interior chaparral). Vegetation productivity on the Apache-Sitgreaves NFs may decrease with warming temperatures, as increasingly negative water balances constrain photosynthesis, although this may be partially offset if CO_2 fertilization increases water use efficiency in plants. Piñon-juniper woodlands, a key Apache-Sitgreaves NFs PNVT, are water limited systems; piñon-juniper ecotones are sensitive to environmental fluctuations and existing canopy structure that may provide trees a buffer against drought. However, severe multiyear droughts periodically cause dieback of piñons, which may overwhelm local buffering. Since the early 1900s, the size and severity of the recent drought and piñon *Ips* beetle (*Ips confusus*) related die-off is unprecedented for the White Mountains and Coconino Plateau (Lynch et al., 2008).

Interdecadal climate variability strongly affects interior dry ecosystems, causing considerable growth during wet periods. This growth increases the evaporative demand, setting up the ecosystem for dieback during the ensuing dry period (Swetnam and Betancourt, 1997). The current dieback is historically unprecedented in its combination of fire suppression, low precipitation, and high temperatures. Increased drought stress via warmer climate is the predisposing factor, and piñon mortality and fuel accumulations are contributing factors. Ecosystem change may arise from large scale, severe fires that lead to colonization of invasive species, which further compromises the ability of piñons to reestablish. There is no simple way to predict these changes at the forest planning scale, although the science community is working on appropriate scale models that would assist forest managers in forecasting vegetation trends under different climate scenarios (Joyce et al., 2008).

Temperature increases contribute to lethal stresses on western forest ecosystems, increasing negative water balances and frequency, severity, and extent of disturbances (e.g., fire, insect outbreaks). Human development of the West has resulted in habitat fragmentation, creation of migration barriers (e.g., dams) and introduction of invasive species. The combination of development, invasive species, complex topography, and climate change is likely to lead to a loss of regional biological diversity. However, some species may migrate to higher altitudes in mountainous areas. It is also possible that some ecosystems (e.g., alpine) would virtually disappear from the region (Joyce et al., 2008).

Natural ecological processes having the greatest impact on the Apache-Sitgreaves NFs include insects, diseases, fires, droughts, inland storms caused by hurricanes, flash flooding, windstorms, ice storms, and the introduction of nonnative species. Climate variability and changes can alter the frequency, intensity, timing, and spatial extent of these natural events. Many potential consequences of future climate change are expected to be buffered by the resilience of Apache-Sitgreaves NFs plant and animal communities to natural climatic variation. However, an extensive body of literature suggests that new disturbance regimes under climate change are likely to result in significant disturbances to U.S. forests, with lasting ecological and socioeconomic impacts (Joyce et al., 2001).

Wildfire

Historically, wildfires have been a recurring natural ecological disturbance in conifer forests, piñon-juniper woodlands, interior chaparral, and grassland ecosystems of the Apache-Sitgreaves NFs. An analysis of wildfire and climate trends in the western United States from 1974 to 2004 shows that the frequency of large wildfires and fire season length increased substantially after 1985 (Westerling et al., 2006). These changes were closely linked with earlier spring snowmelt and increases in spring and summer air temperatures. Earlier spring snowmelt probably contributed to greater wildfire frequency by extending the period during which ignitions could occur and by reducing water availability to ecosystems before the arrival of the summer monsoons, thus enhancing drying of vegetation and surface fuels (Westerling et al., 2006). These trends of increased fire size correspond with the increased cost of fire suppression.

In recent years, western forests have been increasingly impacted by wildfires, burning homes and wildlands; suppression costs have totaled more than $1 billion per year for Federal land management agencies. Since about the mid-1970s, the total acreage burned and the wildfire severity in ponderosa pine and mixed-conifer forests has increased. Fire frequency and severity may be exacerbated if temperatures increase, precipitation decreases, and overall drought conditions become more common. In addition, continued population growth would likely increase human-caused fires, since humans start nearly half of the fires in the Southwest. In 2011, for example, the Wallow Fire was determined to be human-caused and occurred in Apache, Navajo, Graham, and Greenlee Counties in Arizona and Catron County, New Mexico. It also spread to the Fort Apache and San Carlos Indian Reservations. At more than 538,000 acres, the Wallow Fire is the largest fire on record in Arizona.

Insects and Pathogens

Insects and pathogens are significant natural occurring ecological processes within forest ecosystems in the U.S., costing 1.5 billion dollars annually (Dale et al., 2001). Extensive reviews of the effects of climate change on insects and pathogens have reported many cases where climate change has affected and/or would affect forest insect species range and abundance, as witnessed in the Southwest. Climate also affects insect populations indirectly through effects on hosts. Insect and pathogen populations have responded to variability in climate and changing forest character (especially to changing structure and species composition) on the Apache-Sitgreaves NFs (Lynch et al., 2010). Drought stress from decreased precipitation and/or warming reduces the ability of a tree to mount a defense against insect attack. This stress may also cause some host species to become more palatable to some types of insects. Fire suppression and large areas of susceptible trees, a legacy from logging, may also increase insect and pathogen populations (Ryan et al., 2008).

Invasive Species

Disturbance may reset and rejuvenate some ecosystems in some cases and cause enduring change in others. For example, climate change may favor the spread of invasive, nonnative grasses into arid lands where the native vegetation is too sparse to carry a fire. When these areas burn, they typically convert to nonnative monocultures and the native vegetation is lost (Ryan et al., 2008). The Apache-Sitgreaves NFs suffer from many types of invasive species outbreaks, including plants (e.g., yellow star-thistle, musk thistle, cheatgrass, salt cedar, weeping lovegrass) and animals (e.g., bullfrog, crayfish). Collectively, 58 nonnative invasive plant species currently infest roughly 30,000 acres on the Apache-Sitgreaves NFs (Forest Service, 2008). Invasive plants can

alter landscapes by overtaking native species, facilitating fire outbreaks, and altering the food supply for herbivorous animals and insects. For example, weeping lovegrass was introduced to the region for cattle feed and erosion control in the mid-1900s, but has since moved from ranchlands and roadways into the forest, woodland, and grassland communities on the Apache-Sitgreaves NFs. Subsequently, this grass displaced native species.

Specific Habitats on the Apache-Sitgreaves NFs

Our knowledge of possible climate change impacts on specific vegetation types remains limited. However, projected and observed climate change effects are being studied at the broad scale habitat level throughout the Southwest. The mild nature of climate gradients among lower life zones of the Southwest and protracted ecotonal bands make woodland plant communities particularly vulnerable (Allen and Breshears, 1998; Adams et al., 2009). Many of the region’s plant and animal species are associated with these key habitats and are important when considering the potential impacts of climate change on ecosystems managed by the Forest Service in the Southwest.

Subalpine

Subalpine habitats are very susceptible to climate change in the Southwest, given their limited extent and marginal existence. Analyses of the ecological model results when driven by different climate scenarios indicate changes in the location and area of potential habitats for many tree species and plant communities. For example, subalpine habitats found on the Apache-Sitgreaves NFs, and the variety of species dependent upon them, are likely to be greatly reduced. In some areas of the contiguous U.S., subalpine ecosystems are projected to all but disappear from western mountains (Joyce et al., 2001). On the Apache-Sitgreaves NFs, subalpine habitat is projected to be replaced by ponderosa pine (Ironside et al., 2010). Increasing temperatures and shifting precipitation patterns may further limit the extent of subalpine vegetation (Lenihan et al., 2008).

Upward elevational shifts of plants in subalpine ecotones have been increasing in North America. Some researchers have reported upward elevational shifts in subalpine vegetation due to climate. Assessing the vulnerability of species and locations in subalpine zones to climate change is an important issue for their conservation (Lenihan et al., 2008) and for the wildlife species that depend on alpine habitats. Subalpine species are at higher risk of extinction as suitable habitats rapidly disappear from mountaintops (Christensen et al., 2007). Some wildlife may be reliant on snowpack melting to set phenological clocks (Inouye, 2008). Warm summer temperatures may force a reduction in daytime foraging by large herbivores whose tolerance for heat is lower than species adapted to warmer weather (Aublet et al., 2009).

Riparian

Riparian habitats are very important for wildlife on the Apache-Sitgreaves NFs; approximately 511 wildlife and fish species (32 fish, 13 amphibian, 324 birds, 105 mammals, 36 reptiles) (Vander Lee et al., 2006), as well as an unknown number of invertebrate and plant species, inhabit or use riparian areas at some time during their life. Research predicts that as climate changes, water inputs are expected to decline due to reduced precipitation and, subsequently, reduced water in riparian zones. Water losses are also likely to increase due to elevated evapotranspiration rates at higher temperatures and greater runoff losses associated with increased frequencies of

high intensity convectional storms. Urban expansion would also increase human demand for water and further reduce water availability for wildland ecosystems. Decreased water availability would affect riverine and riparian ecosystem function, due to modifications in geomorphological processes and an overall reduction in the availability of moisture to plant communities. Although these areas compose less than 1 percent of Apache-Sitgreaves NFs lands, they provide critical habitat for vertebrates, invertebrates, migratory birds, and other riparian-dependent species. Reduced water inputs would cause riparian ecosystems to shrink. Furthermore, lowered water availability would stress riparian plants and increase the ecosystem susceptibility to invasion by nonnative plants (e.g., salt cedar, Russian olive) which in turn would disrupt the natural wildlife community (Archer and Predick, 2008).

Wetlands and Cienegas

Climate change is likely to affect native plant and animal species by altering key habitats such as the wetland/cienega, fen, and bog ecosystems (Karl et al., 2009). There are roughly 11,825 acres of wetland/cienega riparian areas on the Apache-Sitgreaves NFs (Forest Service, 2008). Wetlands/cienegas create unique habitats and microclimates that support diverse wildlife and plant communities. Wetlands/cienegas can exist with little or no water for long periods, or have several wet/dry cycles each year. When it rains, what appeared to be only a few clumps of short, dry grasses suddenly teem with aquatic plants and animals. Wetlands/cienegas provide a perfect habitat for migrating birds to feed, mate, and raise their young (Karl et al., 2009). Wetlands/cienegas also serve as natural wastewater purification systems. Wetlands/cienegas perform two important functions in relation to climate. They have mitigation effects through their ability to store carbon and have adaptation effects through their ability to store and regulate water flows. Due to their ability to store and slowly release water, properly functioning wetlands/cienegas are vital during periods of extreme droughts.

Aquatic Systems

There are already observed shifts in the timing of snowmelt in the American West which, along with increases in summer air temperatures, have serious implications for the survival of fish species and may render some efforts to reintroduce species into their historic range useless (Millar et al., 2007). Of the 14 native fish species found on the Apache-Sitgreaves NFs, 7 are currently protected under the Endangered Species Act (Forest Service, 2008). For cool and cold-water species, a nearly 50 percent reduction in thermal habitat is projected with scenarios of increased water temperatures (Eaton and Scheller, 1996). Predicted impacts to aquatic ecosystems include altered seasonal high flow events, increases in drought severity during summer flows, and increasing temperatures in small streams and tributaries that further limit habitat during seasonal flows (Williams and Carter, 2009).

The fundamental physiological components of growth and metabolism are strongly affected by temperature (Schmidt-Nielsen, 1997). For fish highly adapted to local climates, higher water temperature decreases feeding and increases metabolism; resulting in decreased growth. Fish increase feeding rates to compensate for poor growing conditions leading to greater visibility and encounters with predators. Trout in whole lake experiments had lower survival at temperatures above optimum; those populations with the highest temperatures and lowest food abundance experienced the lowest survival. The prediction is for an increasing frequency of poor or failed year classes where fish cannot escape the warmer conditions. Research, so far, reflects a basic understanding of the impacts of climate warming on individuals but not on the outcomes at the

population levels (Biro et al., 2007). Current stresses on native aquatic species, including heat-tolerant nonnatives, add to the complexity of managing and adapting to climate change.

Plant and Animal Species

The Nature Conservancy (Vander Lee et al., 2006) produced a list of 511 known and potential vertebrate species on the Apache-Sitgreaves NFs, accounting for 14 native fish, 18 nonnative fish, 13 amphibian, 36 reptile, 324 bird, and 105 mammal species. In addition, there are roughly 2,500 plant species and potentially several thousand invertebrate species found on the forests. The White Mountains harbor several endemic species found primarily or exclusively on the forests. Twenty-one invertebrates have been found only in the White Mountains (Stevens, 2007), while five small mammals and one fish are found primarily there (AZGFD, 2007; Hoffmeister 1986; NatureServe Web site 2007, 2008, 2009). Another three mammal species found in the White Mountains are more widespread, but occur only within Arizona (AZGFD, 2007).

Research suggests large changes in the structure and species composition of plant communities due to the warming air temperatures and altered hydrological cycles. Many of the region's plant, animal, and insect species depend on precise phenological events based on climatic conditions for migration, flowering, and timing for foraging and reproductive activities. Climate thus influences their distribution and abundance through changes in resource availability, fecundity, and survivorship. It is currently unknown how many species would successfully adapt to changing conditions. The ability of plant and animal species to migrate under climate change is strongly influenced by their dispersal abilities and by disturbances to the landscape. Land use changes and habitat alterations around the Apache-Sitgreaves NFs would add to the challenge of plant and animal species adapting to climate change. Within an ecological context, wildlife and plant responses to climate change in the region are highly dependent on interactions between weather, land use, land cover, hydrology, fire, and stresses from invasive, nonnative species.

Distribution

Many studies support the predictions of changes in species distribution related to climate change especially related to temperature and precipitation changes. Temperature is likely to be the main driver for different species, including possible shifts in a coordinated and systematic manner throughout broad regions (Rosenzweig et al., 2007). Species at the upper elevations are at greater risk of extirpation since they may not be able to adapt to habitat changes. Other species such as White Mountains water penny beetle (*Psephenus montanus*), New Mexico meadow jumping mouse (*Zapus hudsonius luteus*), and Three Forks springsnail (*Pyrgulopsis trivialis*) are also at risk due to their limited distribution and occurrences, or they are unable to disperse or adapt to keep up with the high rates of climate change. Such organisms face increased risk of extinction (Hoegh-Guldberg et al., 2008). In many instances, the impacts of range shifts would go far beyond the mere addition or subtraction of a species to or from a system. Some range shifts would have cascading effects on community structure and the functioning of ecosystems (Lawler et al., 2009).

Habitat Quality

Climate change may cause a host of physical consequences to the ecosystems, which may in turn affect the quality of plant and animal habitats. This may occur through a decrease in available water, changes in vegetation type through decline in vigor, severe drought or fire, or through

changes in hydrology. Large areas of forest that were once habitat for some wildlife species may no longer be suitable, potentially leading to significant changes in species due to loss of needed habitat components (Karl et al., 2009). In their current state, the sustainability of 9 of the 14 major PNVTs on the Apache-Sitgreaves NFs is already at risk (Forest Service, 2008) without factoring in potential effects of climate change.

Behavior and Biology

The timing of seasonal activities of plants and animals is perhaps the simplest process by which to track responses of species to climate change. Observed phenological events include leaf unfolding, flowering, fruit ripening, leaf coloring, leaf fall of plants, bird migration, chorusing of amphibians, and appearance/emergence of insects (Rosenzweig et al., 2007).

Large herbivores, such as pronghorn antelope, inhabiting highly seasonal temperate environments are subject to drastic daily and seasonal changes in environmental quality. During summer, they must acquire sufficient resources for growth and reproduction and to survive the following winter. Foraging behavior in summer is thus vitally important. Higher temperatures may reduce the daily activities of large herbivores. This may affect foraging, growth, reproduction, and overall health of animals. They may experience hardship during the winter and may not reproduce as successfully (Aublet et al., 2009). In reptiles and amphibians, increased temperatures, and changing precipitation could negatively affect reproduction, for many of the same reasons as with fish (Hulin et al., 2009). Impacts are also possible to the migration and dispersal routes of many species, including migratory songbirds, which are already of concern due to declines in abundance (Sillett et al., 2000).

Fragmentation and Isolation

Habitat fragmentation could affect the full spectrum of biological diversity, from altering behavior of individuals, their genetics, and the characteristics of populations, which could fundamentally change the structure and function of ecological communities (Lomolino and Perault, 2007). Climate change may contribute to further fragmentation of habitat and creation of migration barriers. Fragmentation and barriers are likely to impede elevational and/or northward migration of many species, resulting in decreases in their total range. Habitat loss and fragmentation may also influence shifts in a species distribution. Empirical evidence shows that the natural reaction of species to climate change is to redistribute to more favorable habitats. However, this redistribution may be hampered by fragmentation isolating suitable areas for colonization and preventing species movements, which may contribute to their extinction (Rosenzweig et al., 2007).

Southwestern Climate Change and Socioeconomic Effects

This literature review found few substantive studies of the possible social and economic effects that climate change might cause or exacerbate in the Southwest. Most climate-related socioeconomic studies are either heavily theoretical, or too broad to apply specifically to the region. Over thousands of years, societies in the Southwest have faced climate change repeatedly—some successfully, some not so successfully (Dean, 2000). It is often difficult to "draw a conceptual line between climate change and other kinds of environmental transformations: both affect human societies by changing the availability of resources" (Tainter, 2000). How societies adapt to climate change is fundamentally dependent on how they approach

problem solving (Tainter, 2000). However, some of the more general social and economic projections can help to inform us about climate change effects on the region.

Population distribution, economic activity, quality of life, and many other human values are influenced by changes in natural environments. Populations in Arizona and New Mexico are growing at unprecedented rates. The combination of population growth and climate change would likely exacerbate climatic effects, putting even greater pressure on water, forest, and other resources. Additionally, pressures put upon agriculture and other climate-sensitive occupations in neighboring Mexico may increase an already large migration of people into the southwestern U.S. (Sprigg et al., 2000; Smith et al., 2001). If conditions become too hot and dry, the number of people moving to the region may decrease.

Recent research in the Southwest shows that up to 60 percent of the climate related trends of river flow, winter air temperature, and snowpack between 1950 and 1999 are human-induced. The study predicts water shortages, lack of storage capabilities to meet seasonally changing river flow, transfers of water from agriculture to urban uses, and other critical impacts (Barnett et al., 2008). The region's economy would likely continue to grow. Increases in service-oriented sectors, as well as the expanding high-tech industry, may bring more jobs and employment opportunities for the growing population. Significant changes due to population pressures include the following: decreased forest cover; increased construction; additional Federal and State parks, wilderness areas, and wildlife refuges; more land utilized for national defense and industry; expanded urban areas; and decreased pasture and rangelands (Joyce and Birdsey, 2000).

Forests significantly enhance the environment in which people live, work, and play. Population levels, economic growth, and personal preferences influence the value that is placed on forests and, consequently, the resources demanded from forests. Changes caused by human use of forests could exceed impacts from climate change. According to the Forest Service (2009), the majority of recreation visitors on the Apache-Sitgreaves NFs come from the Phoenix and Tucson metropolitan areas. According to National Visitor Use Monitoring data, the Apache-Sitgreaves NFs received nearly 2 million visits during 2001, 70 percent of those visitors came from Maricopa (Phoenix) and Pima (Tucson) Counties. Many Arizonans consider access to public lands a major contributor to the quality of life. Many southwestern forests as well as the Apache-Sitgreaves NFs are experiencing very high recreational use while urban expansion is decreasing the amount of available open space. Climate change could have long term impacts on many of the amenities, goods, and services from forests including recreational opportunities, productivity of locally harvested plants such as berries or ferns, local economics through land use shifts from forest to other uses, forest real estate values, and tree cover and composition in urban areas and associated benefits and costs. Private agricultural, urban, and suburban areas are expanding and affecting Forest Service management. This expansion of human influences into the rural landscape alters natural ecological process patterns associated with fire, flooding, landslides, and native and introduced species. These land use changes are very likely to interact with and potentially exacerbate stresses on forests associated with climate change (Joyce and Birdsey, 2000).

Livestock Grazing

Livestock grazing is one of the management activities occurring on the Apache-Sitgreaves NFs. Ranching is a social, cultural, and agricultural activity throughout the rural Southwest. It is a major land use in both Arizona and New Mexico; its success depends on the natural vegetation

accessible to grazing animals. The Apache-Sitgreaves NFs provide forage for livestock grazing, but they also provide crucial habitat for wildlife. Lands grazed on the Apache-Sitgreaves NFs are not irrigated and any variability in precipitation and temperature directly affects forage plant production and wildlife habitat. Changes in climate may affect the vigor and productivity of forage plants and, thus, the overall conditions of both wildlife habitat and ecological conditions which may affect grazing capability. It is possible that higher temperatures and decreased precipitation predicted for the next century would also decrease forage production and shorten the growing and grazing season, causing a reduction in livestock numbers; while flash floods and increased risk of animal disease can adversely affect the livestock industry (Joyce et al., 2001) dependent upon the Apache-Sitgreaves NFs' forage resources.

Coupled with poor forage conditions, there may be a general scarcity of water for livestock, which may affect grazing capability. For a pasture to be available for grazing, it not only has to have sufficient nutritious vegetation but adequate water as well. Some allotments/pastures rely on wells and developed springs, but many utilize dirt tanks to capture snowmelt and monsoon rainfall for use by livestock. During recent droughts, many dirt tanks on the Apache-Sitgreaves NFs dried up, making many pastures unusable for cattle even though forage may have been available. Ranching is in a vulnerable position, especially when viewed against a backdrop of changing climate, economic structure, urban expansion, increasing population, fluctuating market conditions, resource availability (Sprigg et al., 2000), and changing public policies.

Recreational Value

Climate change affects national forest ecosystems and the relationships people have with those places. Population distribution, economic activity, quality of life, and many other human values are influenced by changes in natural environments. The Apache-Sitgreaves NFs provide many recreational opportunities including hiking, camping, hunting, bird watching, skiing, autumn leaf tours, and water-related activities such as fishing and boating. These activities provide income and employment in every forested region of the U.S. Outdoor recreation opportunities are likely to change, with resulting changes in public expectations and seasonality of use. Higher temperatures are very likely to result in a longer season for summer activities such as backpacking, but a shorter season for winter activities such as dog-sledding, cross-country skiing, and snowshoeing. Areas at low elevations and in more southern parts of the region are very likely to be at risk from shorter snow seasons and rising snowlines (Joyce et al., 2001; Svoma 2009). In areas of marginal annual snowpack, the inability to maintain cross-country skiing may result in the closure of some ski areas.

Urban and suburban expansion into undeveloped lands is likely to shift in response to climate change. Population shifts may cause new resource related human conflicts, and create unforeseen impacts on already stressed urbanized ecosystems. As temperatures increase in lowland, urban areas, recreation is expected to increase on the Apache-Sitgreaves NFs (Forest Service, 2009), where cooler temperatures would attract people to higher elevations, with the forests becoming more of a refuge from increasingly hot summers (Irland et al., 2001).

Wood Products

Changes in climate and the consequent impacts on forests would likely change market incentives for investment in biomass technology and in wood conservation techniques. The market for wood products in the U.S. is highly dependent on the area and species composition of forests, supplies

of wood, technological change in production and use, availability of wood substitutes, demand for wood products, and international competition. Rising atmospheric CO_2 would increase forest productivity and carbon storage in forests if sufficient water and nutrients are available. Any increased carbon storage would be primarily in live trees. However, in the Southwest and Apache-Sitgreaves NFs, as discussed above, overall production may be limited by decreased available water. While increases in wildfire may decrease some available wood supply, treatment of wildland-urban interface areas and restoration of fire-adapted ecosystems in the Southwest and Apache-Sitgreaves NFs may actually increase the overall availability of small diameter timber and related wood products (Joyce et al., 2001).

Multiple socioeconomic impacts often follow drought and severe insect outbreaks. Timber production, manufacturing, and markets may not be able to take advantage of vast numbers of killed trees. In addition, when insect outbreaks occur, the public often perceives this as an increased fire risk and as detrimental to the aesthetics of montane areas (Ryan et al., 2008). These factors could drive future public policy. Furthermore, wood supplies would vary by forest and woodland type (Sprigg et al., 2000; Joyce et al., 2001).

Health

Future climate scenarios would undoubtedly amplify current climatically driven human health concerns, with potential increased risk of dengue fever,[9] encephalitis, and other diseases associated with warmer climes, and the northern movement of disease vectors, such as malaria-carrying mosquitoes. Diseases such as valley fever and Hantavirus pulmonary syndrome are endemic in the Southwest. The incidence of Hantavirus has been linked to seasonal and interannual patterns of rainfall (Eisen et al., 2007). Research strongly suggests that valley fever is connected to the sequence and pattern of precipitation and wind. Future climate scenarios would undoubtedly amplify current climatically driven human health concerns. Projected temperature increases are anticipated to create greater numbers of heat-induced illnesses, reduced air quality, and increased cases of respiratory illness due to the presence and persistence of dust and allergens. Conversely, in many temperate areas—which include the Southwest—there is clear seasonal variation in mortality; death rates during the winter season are 10 to 25 percent higher than in the summer. Several studies cited by the IPCC indicate that decreases in winter mortality may be greater than increases in summer mortality under climate change (McMichael et al., 2001). The geographical range of disease-bearing vectors, such as the mosquito, would expand under the model scenarios for the 21st century (Liverman and Merideth, 2002). Pressures put upon agriculture and other climate-sensitive occupations in neighboring Mexico may increase an already large migration of people into the Southwestern U.S., making disease monitoring increasingly difficult (Sprigg et al., 2000). This is of interest to the Apache-Sitgreaves NFs and surrounding communities because the majority of forest users are from Maricopa and Pima Counties. Increased visitor use could be the vector necessary to spread any number of these health issues.

Energy

Higher air temperatures may increase the overall demand for energy within the region's urban areas and could affect the Southwest's current socioeconomic environment (Sprigg et al., 2000; Smith et al., 2001). Electricity supports human activity and offers the possibility of economic

[9] Dengue fever is a virus-based disease spread by mosquitoes.

growth. For much of the region, water delivery systems rely on electricity for pumping groundwater and for directing water throughout the systems. Urban and agricultural uses of energy driven water resources are essential in the region's current socioeconomic environment. During the warmest summer months, energy demands increase with the use of air-cooling systems. Given population projections for the region, a greater number of electricity generating plants would be needed to handle the demands that follow. Climate warming contributes to increased energy demands and evaporative loss from reservoirs. All reasonable scenarios of future climate variability must be considered when anticipating the costly measures necessary to provide dependable, safe, and reasonable supplies of energy (Sprigg et al., 2000). Increasing energy demand and the ensuing demand for alternative energy would likely impact the Apache-Sitgreaves NFs through a growing need for new energy corridors, requests for wind and solar energy sites, and other special use related requirements, as well as the current and ongoing demand for biomass to fuel existing electrical cogeneration plants.

Key Climate Change Factors for the Apache-Sitgreaves NFs

Based on current projections, the primary regional-level effects of climate change most likely to occur in the Southwest include (1) warmer temperatures, (2) decreasing precipitation, (3) decreased water availability with increased demand, (4) increased extreme disturbance events (natural and human caused), and (5) increased use of the national forests for relief from increased temperatures.

Based on current climate model projections and research, the climate change factors that appear most likely to affect the Southwestern Region and Apache-Sitgreaves NFs and to affect desired conditions in the revised land management plan are ecological, weather-related disturbances, and socioeconomic demands, as described:

- Projected increase in frequency of extreme weather events (intense storms);
- Projected increase in wildfire risks;
- Projected increase in outbreaks of insects, diseases beyond endemic levels, and nonnative invasive species;
- Projected increase in demand for decreasing upland water supplies; and
- Projected increase in national forest socioeconomic uses and demands.

These natural ecological processes and human-caused disturbance factors and the potential impacts on desired conditions for the national forests in the Southwestern Region and the Apache-Sitgreaves NFs are described below.

Increased Extreme Weather Events

Climate change likely would increase flash floods, making the region's growing population more susceptible to loss of life and property. While the Southwest and Apache-Sitgreaves NFs is expected to become warmer and drier, it is likely to experience more flooding. This relates in part to the fact that warm air holds more moisture than cooler air. The frequency of floods is also influenced by the rate of snowmelt in the winter and spring, the character of the summer monsoon, and the incidence of tropical hurricanes and storms in the autumn.

Hurricanes and other tropical cyclones are projected to become more intense in the future. Since Arizona and New Mexico typically receive 10 percent or more of their annual precipitation from tropical storms, it is likely that this change would also increase flooding. In Arizona and New Mexico, floods killed 57 people between 1995 and 2006; while hundreds of others have needed to be rescued. The economic price tag is also high, costing Arizona, New Mexico, Colorado, and Utah approximately 5 billion dollars between 1972 and 2006. A potential increase in extreme storms, floods, heat waves, and droughts may present challenges for achieving the plan's desired conditions.

Impacts from extreme weather events could include changes in the composition and diversity of desired ecosystems, destruction of habitat, timber loss, increasing damage to the forests' infrastructure (e.g., trails, facilities, roads), and loss of recreation opportunities. Natural ecological process events that exceed the historic range of natural variation can change the makeup, structure, and function of vegetation types and watersheds. Heavy rains and higher flood levels can affect maintenance and structural integrity of forest infrastructure. Flooding is a natural and beneficial process in many aquatic systems. However, damage to aquatic systems from flash flood-caused erosion, downed trees, and inundation can change streamside habitats, affect aquatic life, and impact proper function of stream channels. These extreme weather events could create challenges in the ability of a national forest to achieving plan desired conditions and objectives for aquatic habitat restoration. Overall, increasing weather-related disturbances can divert limited Apache-Sitgreaves NFs staff and funding to recovery efforts for extended periods.

Wildfire

Wildfire is another climate-related impact to ecosystems in the Southwest. Historically, wildfires have played an important role in the vitality of fire-adapted ecosystems. Past management and fire suppression practices, resulting in higher fuel loads, have changed the fire dynamics on the landscapes within the Apache-Sitgreaves NFs, increasing the risk of uncharacteristic wildfire. Fire suppression activities in the West, including those conducted by Federal land management agencies, routinely cost more than 1 billion dollars per year. Since about the mid-1970s, the total acreage area burned and the severity of wildfires in ponderosa pine and mixed-conifer forests have increased on the Apache-Sitgreaves NFs.

Fire frequency and severity would likely increase as temperatures rise and precipitation decreases. Population growth in the Southwest may also lead to greater numbers of human-caused wildfires. For example, the 2002 Rodeo and Chediski Fires on the Fort Apache Indian Reservation and Apache-Sitgreaves NFs were both started by humans and combined to burn nearly half a million acres (Joyce et al., 2008).

Outbreaks of Insects, Diseases, and Nonnative Invasive Species

Disturbances associated with climate change can have secondary impacts caused by wildfire and climate-related extremes. Increased temperature and moisture variations can cause stress and increase the susceptibility of forest ecosystems to insect, disease, and nonnative species. New environmental conditions can alter species mixes and can favor plants and animals that are more adaptable or rapidly colonize new territories (Whitlock, 2008). Species that are already broadly adapted may become more prevalent and species with narrow adaptability may become less prevalent.

According to Lynch et al. (2010), insect and pathogen populations have responded to changing forest character (e.g., structure, species composition) on the Apache-Sitgreaves NFs and variability in climate. They reported that contemporary outbreaks differ from pre-1950s regimes in that *Ips* bark beetle species became more significant than *Dendroctonus* species in ponderosa pine compared to the beginning of the 20th century when the reverse was the case. Damage to white fir by bark beetles and defoliators has increased; dwarf mistletoe incidence and infection severity have increased in ponderosa pine, Douglas-fir, and spruce; and the cumulative effects of several biotic and abiotic agents, which individually are seldom fatal, are causing widespread mortality and decline in aspen. They go on to state that damage in the piñon-juniper woodland and spruce-fir forest is unprecedented in the historic record, in terms of both the severity of damage and in the identity and variety of insects causing damage in the spruce-fir forest. Lynch et al. (2010) also found that coniferous species are replacing aspen in extensive areas and aspen die-off and decline caused by a suite of biotic and abiotic factors has intensified the loss of this species. Extensive areas of damaged piñon-juniper are becoming juniper woodlands or grasslands. The potential for catastrophic insect outbreaks and pathogen-related mortality continues, especially during drought periods. There is also a threat of new exotic insects and pathogens. Contemporary trends are different enough from historic trends to expect altered ecosystem processes.

Desired conditions for healthy vegetation communities on the Apache-Sitgreaves NFs include resilience to dramatic changes caused by abiotic and biotic stressors and mortality agents (e.g., pine beetles), and a balanced supply of essential resources (e.g., light, moisture, nutrients, growing space). Insects and diseases typically invade in cycles, followed by periods of relative inactivity. Nonnative invasive species, such as cheatgrass and salt cedar, are expected to continue to increase in numbers and extent. Active research and new management approaches are focused on addressing forest threats and vulnerabilities to an environment that is departed from the historic range of natural variability.

Diminishing Water Resources

As stated previously, most snowpack areas and upland reservoirs are located on national forests in the Southwest and the Apache-Sitgreaves NFs. In many western mountain ranges, less precipitation is falling as snow and spring melting is occurring earlier. Streamflows in the Colorado, Rio Grande, and several other southwestern rivers appear to be peaking earlier, suggesting that spring temperatures are warmer than in the past, causing snow to melt earlier. Water supplies are projected to become increasingly scarce, calling for tradeoffs among competing uses, potentially leading to conflict. Without upland reservoirs and watersheds, many managed by the Forest Service, elaborate water delivery systems and other infrastructure support, agriculture, urbanization, and other development could be severely constrained. In the Southwest, intense debate would likely continue over resource allocation and conservation of available supplies.

Climate Related Socioeconomic Demand

Populations in Arizona and New Mexico are growing at an unprecedented rate. As of the latest American Communities Survey (2009), Arizona’s population was 6,595,778. The increase for Arizona between 1980 and 2009 was over 123 percent. New Mexico’s current population of 2,009,671 represents a change of over 47 percent between 1980 and 2009. Currently, over 5 million people live within a 5-hour drive of the Apache-Sitgreaves NFs. The combination of

population growth and climate change would likely exacerbate climatic effects, such as increasing visitor use which would put even greater pressure or demand on water, recreational opportunities, and other resources from the Apache-Sitgreaves NFs. Climate change could have long term impacts on many of the amenities, goods, and services from the Apache-Sitgreaves NFs. These include productivity of locally harvested plants (e.g., berries, mushrooms), wildlife, local economics through land use shifts from forest to other uses, forest real estate values, and tree cover and composition in urban areas and associated benefits and costs. Climate, combined with increasing regional population, would increase demand for water-related recreation opportunities on the Apache-Sitgreaves NFs, as residents of urban areas seek relief from rising temperatures. The number of human-caused fire and wildlife-human conflicts would likely increase as well.

Potential Climate Change Strategies for the Apache-Sitgreaves NFs

The five potential management strategies described below relate to the five projected, key climate change factors most likely to be concerns for the Southwestern Region and the Apache-Sitgreaves NFs in moving toward the desired conditions in the revised land management plan. These are extreme weather events; wildfire and human-caused risks; insects, diseases, and invasive species; water use and demand; and increase in socioeconomic demands. These management strategies focus on ways to incorporate changes from disturbances into managed forests and enhance ecosystem resilience.

In developing strategies for managing future changes, the range of possible approaches could be quite broad, but the management strategies listed below are focused on recommendations from recent research studies, including the U.S. Climate Change Science Program, SAP 4.4 (CCSP, 2008b), which are appropriate for the Southwestern Region and the Apache-Sitgreaves NFs and balance effectiveness, feasibility, and available resources. Although some strategies contain new ideas, most of these management options include practices that are already in effect, can serve multiple needs, and may just need to be adjusted or expanded to respond to climate changes during the next 5 to 15 years. Using an adaptive management approach would allow national forest managers to adopt and adjust strategies as new information is available, conditions change, and staff and resources are available.

The key climate change factors are addressed directly or indirectly through the Apache-Sitgreaves NFs desired conditions, objectives, and management strategies:

1. Enhance adaptation by anticipating and planning for disturbances from intense storms;
2. Reduce vulnerability by maintaining and restoring resilient native ecosystems;
3. Increase water conservation and plan for reductions in upland water supplies;
4. Anticipate increases in forest recreation use, utilize markets and demand for small-diameter wood and biomass for restoration, renewable energy, and carbon sequestration; and
5. Monitor climate change influences.

Enhance Adaptation by Anticipating and Planning for Disturbances from Intense Storms

Although occurrences of storms and other disturbances cannot be precisely predicted and are often beneficial types of disturbance, anticipatory planning may predict impacts and have adaptive guidelines in place to protect sensitive areas. Areas such as riparian zones, endangered species habitats, and special areas may require different approaches for reducing disturbances or recovering from damaging events. Management responses from previous events can provide guidance for similar situations and take advantage of prior learning experiences. Prior planning can take advantage of disturbances when they eventually occur to convert vegetation to more resilient and desirable ecosystems and reduce assessment and response time while ensuring that sensitive resources requiring special responses are protected.

With the projected increase in extreme weather events, management practices for reducing soil erosion may be even more critical in the future. For example, standard soil erosion best management practices such as buffers filter strips, broad-based dips, and piling slash downslope of skid trails and along streams, can help mitigate increased erosion conditions. Roads and trails close to streams may be closed, removed, revegetated, or relocated away from stream channels to reduce impacts to aquatic ecosystems and water quality. Further, appropriately sized culverts at stream crossings should consider future runoff projections in a changing climate as well as reference conditions. New recreation sites, such as campgrounds, should be located well away from potential flash flood areas.

Reduce Vulnerability by Maintaining and Restoring Resilient Native Ecosystems

Managing ecosystems under uncertainty necessitates flexible and adaptive approaches that are reversible, implemented in incremental steps, allow for new information and learning, and can be modified with changing circumstances (Millar et al., 2007). Apache-Sitgreaves NFs ecosystems have evolved under a long and complex history of climate variability and change. Taking into consideration the number of mega-droughts and other climate-related variation through time, these plant and animal communities have a built-in resilience. Restoring and maintaining resilience in forest, woodland, chaparral, grassland, and riparian ecosystems are part of the basic elements of forestwide desired conditions, objectives, and management approaches. Risks of increased wildfire, outbreaks of insects and disease, invasive species, and loss of habitat represent ongoing, broad-scale challenges to management of the Apache-Sitgreaves NFs. These issues are nothing new. However, climate change has the potential to increase or augment the impacts of these ecosystem risks.

Restoring and maintaining resilience would likely improve the potential for ecosystems to retain or return to desired conditions after being influenced by climate change related impacts and variability. Managing for resistance (e.g., maintenance thinning to prevent uncharacteristic fire, forest insect or disease epidemics) or resilience (e.g., noxious weed control), both traditional sustainability themes, offer common ground and present opportunities for meaningful response to climate change. Of the themes of resistance[10] or resilience identified by Millar et al. (2007), the following may be useful for planning:

[10] Resistance is the capacity of an organism or a system to withstand the disruptive effects of an environmental agent.

- Manage for asynchrony[11], which promotes diversity
- Promote connected landscapes
- Restore significantly disrupted animal and plant communities

Wildland fire is an existing management tool that can serve multiple purposes, from attaining desired conditions for fire-adapted ecosystems and habitat for threatened and endangered species to reducing fuel loads. It is also an important management strategy for maintaining desired habitats in a changing climate with more natural disturbances. With projections for more frequent storms and other extreme weather events and increased stresses from forest pests in a warmer, drier climate, wildland fire would continue to be an important management strategy for the future.

Although current programs and guidance are already in place to limit the introduction of nonnative species, treat invasive species, and manage insects and diseases, these efforts are likely to become more critical to maintaining desired conditions for healthy plant and animal communities under a changing climate. Because of land ownership patterns, success in reducing forest pests requires going beyond Apache-Sitgreaves NFs' boundaries and collaborating with partners. In addition, management practices (e.g., thinning for age class diversity and structure, reclaiming and restoring native grasslands) that sustain healthy plant and animal communities and provide adequate nutrients, soil productivity, and hydrologic function promote resilience and reduce opportunities for disturbance and damage.

For Wildlife and Plant Species Dependent on Forest Ecosystems

Fragmentation

Apache-Sitgreaves NFs' desired conditions, objectives, and management approaches address preservation, establishment, and restoration of large, unfragmented areas of wildlife habitat. Large, interconnected blocks of habitat support a wide array of species and allow for genetic and behavioral interactions that are lacking with the creation of small patches (Robinson et al., 1995).

Promote Connectivity

Landscape connectivity is the degree to which the landscape facilitates or impedes movement of a species among habitats required for its persistence with few physical or biotic impediments to migration (Taylor et al., 1993; Millar et al., 2007). Connectivity has two components: structural and biological connectivity. Structural connectivity, the spatial structure of a landscape, can be described from map elements. Biological connectivity is the response of individuals to the scale of landscape features (Brooks, 2003). Promoting connectivity in landscapes with management goals that can be modified as conditions change may allow species to respond naturally to changing climates. Desired goals include reducing fragmentation and planning at landscape scales to maximize habitat connectivity (Millar et al., 2007). Apache-Sitgreaves NFs' desired conditions, objectives, and management approaches address the importance and need for connectivity for both terrestrial and aquatic habitats.

[11] Asynchrony, in the general meaning, is the state of not being synchronized. In this usage, asynchrony refers to the promotion of diversity by managing for a range of conditions, occurring at different times, within a given ecosystem.

Riparian Areas

Apache-Sitgreaves NFs' desired conditions, objectives, and management approaches address riparian areas, their respective uplands, and watersheds by emphasizing protection from degradation, enhancement where possible, and maintenance of proper hydrologic functions. The forests also recognize that riparian areas provide important habitat connectivity for terrestrial and aquatic species.

Maintain Biological diversity

By implementing the Apache-Sitgreaves NFs' desired conditions, objectives and management approaches, and the above recommendations, biological diversity would be maintained as much as possible as climate change occurs.

Increase Water Conservation and Plan for Reductions in Upland Water Supplies

As mentioned earlier, a major portion of Arizona's snowpack and the headwaters of several river systems are located on the Apache-Sitgreaves NFs. Aquatic and riparian ecosystems may be negatively impacted by increasing temperatures and reduced precipitation. Too much water arriving at once, from severe storm events, also can affect these water dependent ecosystems. Water amount, availability, distribution, and allocation, for a variety of ecological, wildlife, and aquatic species, as well as for human uses, needs to be considered in planning.

Municipal water supplies of Arizona are dependent on these upland sources. In many western mountain ranges, including the Apache-Sitgreaves NFs, less precipitation falls as snow, and spring melting occurs earlier in the year. These water sources and associated water rights have always been important and contentious areas of concern for public land managers in the Southwest and Apache-Sitgreaves NFs. With climate change, planning for water quantity and quality may become more important. To address such concerns, planners may wish to consider some of the following measures:

- Determine the water rights status for range, wildlife, public drinking systems, firefighting, recreational uses, and aquatic habitats;
- Assess and maintain infrastructure that could be affected by flooding (e.g., dams, bridges, roads, culverts);
- Review current status of State and regional water plans, forest and watershed health plan(s), integrated regional water planning efforts; and
- Plan for extreme events (e.g., flooding and/or drought).

Anticipate Increased Forest Recreation Use, Markets and Demand for Wood and Biomass, Renewable Energy, and Carbon Sequestration

The use of Apache-Sitgreaves NFs as a haven from the summer heat and for water-related recreation continues to grow with population increases throughout the region. Planning for recreation should take into account the possible growth in demand as temperatures increase and precipitation decreases because of climate change. This may affect recreation facilities—like campgrounds and boating facilities—as well as access to lakes, rivers, and other water features. Analysis of both potential snowfall and future winter temperature changes may need to be

considered when additions to, or new construction, of cross-country skiing and other snow-based recreation activities are proposed.

Salvaging and converting biomass into boards, firewood, and other wood products (as a byproduct of forest restoration) can help reduce carbon loss from wildland fire. Another consideration may be to use biomass that cannot be converted to wood products (such as from clearing roads and trails) for the continuation of bioenergy production. Bioenergy production can be carbon neutral and could replace the use of fossil fuels in generators; mobile generation facilities could also provide power to schools, hospitals, command centers, and other immediate needs.

Monitor Climate Change Influences

It is not recommended that the Apache-Sitgreaves NFs create a completely new initiative or program of work solely for monitoring climate change. However, consideration of appropriate adjustments to the monitoring program to improve understanding of the relationships of key plan components and climate change may be needed. As the Apache-Sitgreaves NFs review their existing and potential research natural areas (RNAs), monitoring of climate change effects on specific ecosystems should be part of the research goals considered when building the RNA establishment record.

Climate Change Glossary

The following terms have been gathered by Forest Service researchers from numerous sources including the National Oceanic and Atmospheric Administration (NOAA), Intergovernmental Panel on Climate Change (IPCC), and others. Included are the most commonly referred-to terms in climate change literature and news media. This is only a partial list of terms associated with climate change. See other NOAA or IPCC documents for full glossaries associated with this topic.

Anthropogenic: Resulting from or produced by human beings.

Anthropogenic emissions: Emissions of greenhouse gases, greenhouse gas precursors, and aerosols associated with human activities. These include burning of fossil fuels for energy, deforestation, and land use changes that result in net increase in emissions.

Arid regions: Ecosystems with less than 250 millimeters precipitation per year.

Atmosphere: The gaseous envelope surrounding the Earth. The dry atmosphere consists almost entirely of nitrogen (78.1 percent volume mixing ratio) and oxygen (20.9 percent volume mixing ratio), together with a number of trace gases, such as argon (0.93 percent volume mixing ratio), helium, and radiatively active greenhouse gases such as carbon dioxide (0.035 percent volume mixing ratio) and ozone. In addition, the atmosphere contains water vapor, whose amount is highly variable but typically 1 percent volume mixing ratio. The atmosphere also contains clouds and aerosols.

Biological diversity: The numbers and relative abundances of different genes (genetic diversity), species, and ecosystems (communities) in a particular area.

Carbon dioxide (CO_2): A naturally occurring gas, and also a byproduct of burning fossil fuels and biomass, as well as land use changes and other industrial processes. It is the principal anthropogenic greenhouse gas that affects the Earth's radiative balance. It is the reference gas against which other greenhouse gases are measured and, therefore, has a Global Warming Potential of 1.

Carbon dioxide (CO_2) fertilization: The enhancement of the growth of plants as a result of increased atmospheric carbon dioxide concentration. Depending on their mechanism of photosynthesis, certain types of plants are more sensitive to changes in the atmospheric carbon dioxide concentration.

Climate: Climate may be defined as the "average weather," or more rigorously, as the statistical description of weather in terms of the mean and variability of relevant quantities (e.g., temperature, precipitation, wind) over a period ranging from months to thousands or millions of years. The standard period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the statistical description of the state or condition of the climate system.

Climate change: Climate change refers to a statistically significant variation in either the mean state of the climate or in its variability, persisting for an extended period (typically decades or longer). Climate change may be due to natural internal processes or external forces, or to persistent anthropogenic changes in the composition of the atmosphere or in land use. Note that the United Nations Framework Convention on Climate Change (UNFCCC), in its Article 1, defines "climate change" as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods." The UNFCCC thus makes a distinction between "climate change" attributable to human activities altering the atmospheric composition, and "climate variability" attributable to natural causes. See also climate variability.

Climate feedback: An interaction mechanism between processes in the climate system is called a climate feedback, when the result of an initial process triggers changes in a second process that in turn influences the initial one. A positive feedback intensifies the original process, and a negative feedback reduces it.

Climate model (hierarchy): A numerical representation of the climate system based on the physical, chemical, and biological properties of its components, their interactions and feedback processes, and accounting for all or some of its known properties. The climate system can be represented by models of varying complexity—that is, for any one component or combination of components a "hierarchy" of models can be identified, differing in such aspects as the number of spatial dimensions, the extent to which physical, chemical, or biological processes are explicitly represented, or the level at which empirical parametrizations are involved. Coupled atmosphere/ocean/sea-ice general circulation models (AOGCMs) provide a comprehensive representation of the climate system. There is an evolution toward more complex models with active chemistry and biology. Climate models are applied, as a research tool, to study and simulate the climate, but they are also for operational purposes including monthly, seasonal, and interannual climate predictions.

Climate variability: Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the climate on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the climate system (internal variability), or to variations in natural or anthropogenic external forcing (external variability). See also climate change.

Drought: There is no definitive definition of drought based on measurable processes. Instead, scientists evaluate precipitation, temperature, and soil moisture data for the present and recent past to determine drought status. Very generally, it refers to a period of time when precipitation levels are low, impacting agriculture, water supply, and wildfire hazard.

El Niño: In its original sense, El Niño is warm water current that periodically flows along the coast of Ecuador and Peru, disrupting the local fishery. This oceanic event is associated with a fluctuation of the intertropical surface pressure pattern and circulation in the Indian and Pacific Oceans, called the Southern Oscillation. This coupled atmosphere-ocean phenomenon is collectively known as El Niño Southern Oscillation or ENSO. During an El Niño event, the prevailing trade winds weaken and the equatorial countercurrent strengthens, causing warm surface waters in the Indonesian area to flow eastward to overlie the cold waters of the Peru Current. This event has great impact on the wind, sea surface temperature, and precipitation patterns in the tropical Pacific. It has climatic effects throughout the Pacific region and in many other parts of the world. The opposite of an El Niño event is called La Niña.

Extreme weather event: An extreme weather event is an event that is rare within its statistical reference distribution at a particular place. Definitions of "rare" vary, but an extreme weather event would normally be as rare as or rarer than the 10^{th} or 90^{th} percentile. By definition, the characteristics of what is called extreme weather may vary from place to place. An extreme climate event is an average of a number of weather events over a certain period of time, an average, which is itself extreme (e.g., rainfall over a season).

Greenhouse effect: Greenhouse gases effectively absorb infrared radiation, emitted by the Earth's surface, by the atmosphere itself due to the same gases, and by clouds. Atmospheric radiation is emitted to all sides, including downward to the Earth's surface. Thus, greenhouse gases trap heat within the surface-troposphere system. This is called the "natural greenhouse effect." Atmospheric radiation is strongly coupled to the temperature of the level at which it is emitted. In the troposphere, the temperature generally decreases with height. Effectively, infrared radiation emitted to space originates from an altitude with a temperature of, on average, -19 °C, in balance with the net incoming solar radiation, whereas the Earth's surface is kept at a much higher temperature of, on average, +14 °C. An increase in the concentration of greenhouse gases leads to an increased infrared opacity of the atmosphere and, therefore, to an effective radiation into space from a higher altitude at a lower temperature. This causes a radiative forcing, an imbalance that can only be compensated for by an increase of the temperature of the surface-troposphere system. This is the "enhanced greenhouse effect."

Greenhouse gas (GHG): Gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of infrared radiation emitted by the Earth's surface, the atmosphere, and clouds. This property causes the greenhouse effect. Water vapor (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4), and ozone (O_3) are the primary greenhouse gases in the Earth's atmosphere. Moreover, there are a number of entirely human made greenhouse gases in the atmosphere, such

as the halocarbons and other chlorine and bromine-containing substances, dealt with under the Montreal Protocol. Besides CO_2, N_2O, and CH_4, the Kyoto Protocol deals with the greenhouse gases sulfur hexafluoride (SF_6), hydrofluorocarbons (HFCs), and perfluorocarbons (PFCs).

Phenotype: The visible characteristics of an organism resulting from the interaction of its genetic makeup and environment.

Radiative forcing: Changes in the energy balance of the Earth atmosphere system in response to a change in factors such as greenhouse gases, land use change, or solar radiation. The climate system inherently attempts to balance incoming (e.g., light) and outgoing (e.g., heat) radiation. Positive radiative forcings increase the temperature of the lower atmosphere, which in turn increases temperatures at the Earth's surface. Negative radiative forcings cool the lower atmosphere. Radiative forcing is most commonly measured in units of watts per square meter (W/m^2).

Rangeland: Undeveloped land that is suitable for use by wildlife and domestic ungulates.

Rapid climate change: The nonlinearity of the climate system may lead to rapid climate change, sometimes called abrupt events or even surprises. Some such abrupt events may be imaginable, such as a dramatic reorganization of the thermohaline circulation, rapid deglaciation, or massive melting of permafrost leading to fast changes in the carbon cycle. Others may be truly unexpected, as a consequence of a strong, rapidly changing, forcing of a nonlinear system.

Regeneration: The renewal of a stand of trees through either natural means (seeded onsite or adjacent stands or deposited by wind, birds, or animals) or artificial means (by planting seedlings or direct seeding).

Teleconnections: Atmospheric interactions between widely separated regions that have been identified through statistical correlations (in space and time). For example, the El Niño teleconnection with the southwestern U.S. involves large scale changes in climatic conditions that are linked to increased winter rainfall.

Weather: Describes the daily conditions (individual storms) or conditions over several days (week of record-breaking temperatures) to those lasting less than 2 weeks.

References

Adams, H.D.; M. Guardiola-Claramonte; G.A. Barron-Gafford; J.C. Villegas; D.D. Breshears; C.B. Zou; P.A. Troch; and T.E. Huxman. (2009). Temperature sensitivity of drought-induced tree mortality portends increased regional die-off under global change-type drought. Proceedings of the National Academy of Sciences 106(17): 7063–7066.

Allen, C.D.; and D.D. Breshears. (1998). Drought-induced shift of a forest-woodland ecotone: Rapid landscape response to climate variation. Proceedings of the National Academy of *Sciences* 95(25): 14839–14842.

Archer, S.R.; and K.I. Predick. (2008). Climate change and ecosystems of the southwestern United States. *Rangelands,* June 2008: 23–28.

Arizona Game and Fish Department (AZGFD). (2007). Wildlife 2012 strategic plan. Arizona Game and Fish Department, Phoenix, AZ.

Aublet, J.F.; M. Festa-Bianchet; D. Bergero; and B. Bassano. (2009). Temperature constraints on foraging behaviour of male Alpine ibex (Capra ibex) in summer. *Oecologia,* 2009 159(1): 237–247.

Barnett, T.P.; D.W. Pierce; H.G. Hidalgo; C. Bonfils; B.D. Santer; T. Das; G. Bala; A.W. Wood; T. Nozawa; A.A. Mirin; D.R. Cayan; and M.D. Dettinger. (2008). Human-induced changes in the hydrology of the western United States. *Science,* 319: 1080–1083.

Biro, P.A.; J.R. Post; and D.J. Booth. (2007). Mechanisms of climate-induced mortality of fish populations in whole-lake experiments. Proceedings of the National Academy of Sciences 104(23): 9715–9719.

Brooks, C.P. (2003). A scalar analysis of landscape connectivity. *Oikos*, 102: 466–439.

CCSP. (2008a). The effects of climate change on agriculture, land resources, water resources, and biodiversity in the United States. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Walsh, M.K.; G. Guibert; and R. Hauser (eds.); P. Backlund; A. Janetos; D. Schimel; J. Hatfield; K. Boote; P. Fay; L. Hahn; C. Izaurralde; B.A. Kimball; T. Mader; J. Morgan; D. Ort; W. Polley; A. Thomson; D. Wolfe; M.G. Ryan; S.R. Archer; R. Birdsey; C. Dahm; L. Heath; J. Hicke; D. Hollinger; T. Huxman; G. Okin; R. Oren; J. Randerson; W. Schlesinger; D. Lettenmaier; D. Major; L. Poff; S. Running; L. Hansen; D. Inouye; B.P. Kelly; L. Meyerson; B. Peterson; and R. Shaw (Authors)]. U.S. Department of Agriculture, Washington, DC.

CCSP. (2008b). Preliminary review of adaptation options for climate-sensitive ecosystems and resources. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. [Julius, S.H.; J.M. West (eds.); J.S. Baron; B. Griffith; L.A. Joyce; P. Kareiva; B.D. Keller; M.A. Palmer; C.H. Peterson; and J.M. Scott (Authors)]. U.S. Environmental Protection Agency, Washington, DC.

CCSP. (2008c). Reanalysis of historical climate data for key atmospheric features: Implications for attribution of causes of observed change. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research [Dole, R.; M. Hoerling; and S. Schubert (eds.); P. Arkin; J. Carton; E. Kalnay; R. Koster; R. Pulwarty; G. Hegerl; D. Karoly; A. Kumar; D. Rind; J. Carton; E. Kalnay; and D. Karoly (Authors)]. National Oceanic and Atmospheric Administration, National Climatic Data Center, Asheville, NC.

Christensen, N.; and D.P. Lettenmaier (2006). A multi-model ensemble approach to assessment of climate change impacts on the hydrology and water resources of the Colorado River basin. *Hydrology and Earth System Sciences*, 3: 3727–3770.

Christensen, J.H., B. Hewitson; A. Busuioc; A. Chen; X. Gao; I. Held; R. Jones; R.K. Kolli; W.-T. Kwon; R. Laprise; V. Magaña Rueda; L. Mearns; C.G. Menéndez; J. Räisänen; A. Rinke; A. Sarr; and P. Whetton. (2007). Regional climate projections. Chapter 11, pp 847–940. In: Solomon, S.; D. Qin; M. Manning; Z. Chen; M. Marquis; K.B. Averyt; M. Tignor; and H.L. Miller (eds.). Climate change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press, New York, NY.

Clark, J.S. (1998). Why trees migrate so fast: Confronting theory with dispersal biology and the paleorecord. *The American Naturalist,* 152(2): 204–224.

Conley J.; H. Eakin; T.E. Sheridan; and D. Hadley. (1999). CLIMAS ranching case study: Year 1. Report Series: CL3-99. Institute for the Study of the Planet Earth. Arizona State University, Tucson, AZ.

Dale, V.H.; L.A. Joyce; S. McNulty; R.P. Neilson; M.P. Ayers; M.D. Flannigan; P.J. Hanson; L.C. Irland; A.E. Lugo; C.J. Peterson; D. Simberloff; F.J. Swanson; B.J. Stocks; and B.M. Wotton. 2001. Climate change and forest disturbances. *BioScience* 51(9): 723–734.

Dean, J.S. (2000). Complexity theory and sociocultural change in the American southwest. Chapter 3, pp. 89-118. In: McIntosh, R.J.; J.A. Tainter; and S.K. McIntosh, (eds.). The way the wind blows: Climate, history, and human action. Columbia University Press, New York, NY.

Eaton, J.G.; and R.M. Scheller. (1996). Effects of climate warming on fish thermal habitat in streams of the United States. *Limnology and Oceanography*, 41(5): 1109–1115.

Eisen, R.B.; G.E. Glass; L. Eisen; J. Cheek; R.E. Enscore; P. Ettestad; and K.L. Gage. (2007). A spatial model of shared risk for plague and Hantavirus Pulmonary Syndrome in the southwestern United States. *American Journal of Tropical Medicine and Hygiene,* 77: 999–1004.

Enquist, C., and D. Gori. (2008). Implications of recent climate change on conservation priorities in New Mexico. A climate change vulnerability assessment for biodiversity in New Mexico, Part 1. The Nature Conservancy and Wildlife Conservation Society, Tucson, AZ.

Farber, S.C.; R. Costanza; and M.A. Wilson. (2002). Economic and ecological concepts for valuing ecosystem services. *Ecological Economics*, 41: 375–392.

Forest Service, U.S. Department of Agriculture. (2008). Ecological sustainability report: Apache-Sitgreaves National Forests. Southwestern Region, Springerville, AZ.

Forest Service, U.S. Department of Agriculture. (2009). Apache-Sitgreaves National Forests economic and social sustainability assessment. Apache-Sitgreaves National Forests. Southwestern Region, Albuquerque, NM.

Guido, Z. (2008). Fire: Frequency and size. Climate Assessment for the Southwest. University of Arizona, Institute for the Study of Planet Earth, Tucson, AZ. [online] URL: http://www.southwestclimatechange.org/impacts/land/fire

Gonzalez, G.A. (2005). Urban sprawl, global warming and the limits of ecological modernisation. *Environmental Politics,* 14(3): 344–362.

Herweijer, C.; R. Seager; E.R. Cook; and J. Emile-Geay. (2007). North American droughts of the last millennium from a gridded network of tree-ring data. *Journal of Climate,* 20: 1353–1376.

Hoegh-Guldberg, O.; L. Hughes; S. McIntyre; D.B. Lindenmayer; C. Parmesan; H.P. Possingham; and C.D. Thomas. (2008). Assisted colonization and rapid climate change. *Science*, 321(5887): 345–346.

Hoffmeister, D.F. (1986). Mammals of Arizona. University of Arizona Press, Tucson, AZ.

Hughes, M.K.; and H.F. Diaz. (2008). Climate variability and change in the drylands of western North America. *Global and Planetary Change*, 65: 111–118.

Hughes, M.K.; P.R. Sheppard; A.C. Comrie; G.D. Packin; and K Angersbach. (2002). The climate of the U.S. Southwest. *Climate Research,* 21(3): 219–238.

Hulin, V.; V. Delmas; M. Girondot; M.H. Godfrey; and J-M. Guillon. (2009). Temperature-dependent sex determination and global change: Are some species at greater risk? *Oecologia*, 160(3): 493–506.

Inouye, D.W. (2008). Effects of climate change on phenology, frost damage, and floral abundance of montane wildflowers. *Ecology,* 89(2): 353–362.

IPCC. (2007). Climate change 2007: The physical science basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S.; D. Qin; M. Manning; Z. Chen; M. Marquis; K.B. Averyt; M. Tignor; and H.L. Miller (eds.)]. Cambridge University Press, New York, NY.

Irland, L.C.; D. Adams; R. Alig; C.J. Betz; C-C. Chen; M. Hutchins; B.A. McCarl; K. Skog; and B.L. Sohngen. (2001). Assessing socioeconomic impacts of climate change on US forests, wood-product markets, and forest recreation. *BioScience,* 51(9): 753–764.

Ironside, K.E., N.S. Cobb, K.L. Cole, M. Peters, J. Eischeid, and G. Garfin. (2010). Plausible future effects of climate change on ponderosa pine. Presentation at the Flagstaff Climate Adaptation Workshop of April 2010. The Nature Conservancy, Flagstaff, AZ.

Joyce, L.A.; and R. Birdsey, (tech coords.). (2000). The impact of climate change on America's forests. A technical document supporting the 2000 U.S. Forest Service RPA Assessment. Gen. Tech. Rep. RMRS-GTR-59. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fort Collins, CO.

Joyce, L.; J. Aber; S. McNulty; V. Dale; A. Hansen; L. Irland; R. Neilson; and K. Skog. (2001). Potential consequences of climate variability and change for the forests of the United States. Chapter 19, pp. 489–522. In: Climate change impacts on the United States: The potential consequences of climate variability and change. National Assessment Synthesis Team (ed.). A Report for the US Global Change Research Program. Cambridge University Press. New York, NY.

Joyce, L.; R. Haynes; R. White; and R.J. Barbour, (tech. coords.). (2006). Bringing climate change into natural resource management: Proceedings. Gen. Tech. Rep. PNW-GTR-706. U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station, Portland, OR.

Joyce, L.A.; G.M. Blate; J.S. Littell; S.G. McNulty; C.I. Millar; S.C. Moser; R.P. Neilson; K. A. O'Halloran; and D.L. Peterson. (2008). National forests. Chapter 3, pp. 1–127 In: Preliminary review of adaptation options for climate-sensitive ecosystems and resources. Julius, S.H., and J.M. West (eds.). A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research. U.S. Environmental Protection Agency, Washington, DC.

Karl, T.R; J.M. Melillo; and T.C. Peterson, (eds.). (2009). Global climate change impacts in the United States. Cambridge University Press. New York, NY.

Lawler, J.J.; S.L. Shafer; D. White; P. Kareiva; E.P. Maurer; A.R. Blaustein; and P.J. Bartlein. (2009). Projected climate-induced faunal change in the Western Hemisphere. *Ecology,* 90(3): 588–597.

Lenart, M. (2007). Global warming in the Southwest: Projections, observations, and impacts. Climate Assessment for the Southwest. University of Arizona, Institute for the Study of Planet Earth, Tucson, AZ.

Lenart, M. (2008). Regional climate modeling. Climate Assessment for the Southwest. University of Arizona, Institute for the Study of Planet Earth, Tucson, AZ. [online] URL: http://www.southwestclimatechange.org/contributors/melanie-lenart

Lenihan et al. (2008). Response of vegetation distribution ecosystem productivity & fire to climate change scenarios for CA. *Climatic Change*, (2008) 87 (Suppl. 1):S215–S230.

Liverman, D.M.; and R. Meredith. (2002). Climate and society in the US Southwest: the context for a regional assessment. *Climate Research*, 21: 199–218.

Lomolino, M.V.; and D.R. Perault. (2007). Body size variation of mammals in a fragmented, temperate rainforest. *Conservation Biology,* 21(4): 1059–1069.

Lynch, A.M.; J.A. Anhold; J.D. McMillin; S.M. Dudley; R.A. Fitzgibbon; and M.L. Fairweather. (2008). Forest insect and disease activity on the Coconino N.F., 1918-present. U.S. Forest Service, Report for the Coconino N.F./Regional Analysis Team. Arizona Zone Office Forest Health Protection, U.S. Forest Service, Flagstaff, AZ.

Lynch A.M.; J.A. Anhold; J.D. McMillin; S.M. Dudley; R.A. Fitzgibbon; and M.L. Fairweather. (2010). Forest insect and disease activity on the Apache-Sitgreaves NFs and Fort Apache Indian Reservation, 1918–2009. U.S. Forest Service, Report for the Apache-Sitgreaves NFs/Regional Analysis Team. Arizona Zone Office Forest Health Protection, U.S. Forest Service, Flagstaff, AZ.

Maurer, E.P.; and H.G. Hidalgo (2008). Utility of daily vs. monthly large-scale climate data: An intercomparison of two statistical downscaling methods. *Hydrology and Earth System Science,* 12: 551–563.

McMichael, A.; A. Githeko; R. Akhtar; R. Carcavallo; D. Gubler; A. Haines; R.S. Kovats; P. Martens; J. Patz; A. Sasaki; K.L. Ebi; D. Focks; L. Kalkstein; E. Lindgren; S. Lindsay; and R. Sturrock. (2001). Human health. Chapter 9, pp. 451–485. In: McCarthy, J.J.; O.F. Canziani; N.A. Leary; D.J. Dokken; and K.S. White, (eds.). Climate change 2001: Impacts, adaptation, and vulnerability. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Published for the Intergovernmental Panel on Climate Change. Cambridge University Press. New York, NY.

McPhee, J.C.; A.C. Comrie; and G.G. Garfin. (2004). A Climatology of drought for Arizona. Drought: Variability monitoring, impacts, and prediction. University of Arizona, Tucson, AZ (Joint with the 15th Symposium on Global change and Climate Variations and the 14th Conference on Applied Climatology: Hall 4AB) Joint Poster Session 3, Monday, 12 January 2004, 2:30 PM-4:00 PM. The 84th American Meteorological Society Annual Meeting, Seattle, WA.

Meko, D.M.; C.A. Woodhouse; C.A. Baisan; T. Knight; J.J. Lukas; M.K. Hughes; and M.W. Salzer. (2007). Medieval drought in the upper Colorado River basin. *Geophysical Research Letters,* 34(L10705): 1–5.

Millar, C.I.; N.L. Stephenson, and S.L. Stephens. (2007). Climate change and forests of the future: Managing in the face of uncertainty. *Ecological Applications,* 17(8): 2145–2151.

Owen, G. (2008). Invasive species. Climate Assessment for the Southwest. University of Arizona, Institute for the Study of Planet Earth, Tucson, AZ. [online] URL: http://www.southwestclimatechange.org/impacts/land/invasive-species

Robinson, S.K.; F.R. Thompson; T.M. Donovan; D.R. Whitehead; and J. Faaborg. (1995). Regional forest fragmentation and the nesting success of migratory birds. *Science,* 267(1): 1987–1990.

Rosenzweig, C.; G. Casassa; D.J. Karoly; A. Imeson; C. Liu; A. Menzel; S. Rawlins; T.L. Root; B. Seguin; and P. Tryjanowski, (2007). Assessment of observed changes and responses in natural and managed systems. Chapter 1, pp. 79–131. In: M.L. Parry; O.F. Canziani; J.P. Palutikof; P.J. van der Linden; and C.E. Hanson, (eds.). Climate change 2007: Impacts, adaptation and vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge University Press. New York, NY.

Ryan, M.; S. Archer; R. Birdsey; C. Dahm; L. Heath; J. Hicke; D. Hollinger; T. Huxman; G. Okin; R. Oren; J. Randerson; and W. Schlesinger. (2008). Land resources. Chapter 3, pp. 75–121. In: The effects of climate change on agriculture, land resources, water resources, and biodiversity. A Report by the U.S. Climate Change Science Program and the Subcommittee on Global Change Research, Washington, DC.

Sammis, T. (2001). Current, past, and future climate of New Mexico. New Mexico Climate, The Climate Center, Las Cruces, NM. [online] URL: http://weather.nmsu.edu/News/climatefall01.pdf

Schmidt-Nielsen, K. (1997). Animal physiology: Adaptation and environment. Cambridge University Press. New York, NY.

Seager, R.; M. Ting; I. Held; Y. Kushnir; J. Lu; G. Vecchi; H-P. Huang; N. Harnik; A. Leetmaa; N-C. Lau; C. Li; J. Velez; and N. Naik. (2007). Model projections of an imminent transition to a more arid climate in southwestern North America. *Science*, 316(5828): 1181–1184.

Seager, R.; R. Burgman; Y. Kushnir; A. Clement; E. Cook; N. Naik; and J. Miller. (2008). Tropical Pacific forcing of North American medieval megadroughts: Testing the concept with an atmosphere model forced by coral-reconstructed SSTs. *Journal of Climate*, 21: 6175–6190.

Sillett, T.S.; R.T. Holmes; and T.W. Sherry. (2000). Impacts of a global climate cycle on population dynamics of a migratory songbird. *Science*, 288: 2040–2042.

Sky Island Alliance. (2007). Restoring connections: Climate change. *Newsletter of the Sky Island Alliance,* 10(2): 1–15.

Smith, J.B.; R. Richel; and B. Miller. (2001). The potential consequences of climate variability and change: The western United States. Chapter 9, pp. 219–245. In: Climate change impacts on the United States: The potential consequences of climate variability and change. National Assessment Synthesis Team (ed.). A Report for the U.S. Global Change Research Program. Cambridge University Press. New York, NY.

Sprigg, W.A.; T. Hinkley et al. (2000). Preparing for a Changing Climate: The Potential Consequences of Climate Variability and Change: Southwest. A Report of the Southwest Regional Assessment Group. University of Arizona. The Institute for the Study of Planet Earth, Tucson, AZ, U.S. Global Change Research Program: 66.

State of New Mexico. (2005). Potential effects of climate change on New Mexico. Agency Technical Work Group. [Musick, B. (ed.); J. Allen; T. Darden; R. Floyd; M. Gallaher; D. Jones; K. Kostelnik; K. Kretz; R. Lucero; R. Romero; B. Toth; M. Uhl; and L. Weaver (contribs.)]. NM.

Stevens, L.E. (2007). A review of invertebrate species of management concern on five northern Arizona forests: Final Report. Unpublished report to five national forests in Southwestern Region.

Swetnam, T.W.; and J.L. Betancourt. (1997). "Mesoscale disturbance and ecological response to decadal climatic variability in the American Southwest." *Journal of Climate,* 11: 3128–3147.

Swetnam, T.W.; C.D. Allen; and J.L. Betancourt. (1999). Applied historical ecology: Using the past to manage for the future. *Ecological Applications,* 9(4): 1189–1206.

Tainter, J.A. (2000). Global change, history, and sustainability. Chapter 12, pp. 331-356. In: McIntosh, R.J.; J.A. Tainter; and S.K. McIntosh, (eds.). The way the wind blows: Climate, history, and human action. Columbia University Press. New York, NY.

Taylor, P.D.; L. Fahrig; K. Henein; and G. Merriam. (1993). Connectivity is a vital element of landscape structure. *Oikos*, 68: 571–573.

Trouet, V.; J. Esper; N.E. Graham; A. Baker; J.D. Scourse; and D.C. Frank. (2009). Persistent positive North Atlantic oscillation mode dominated the medieval climate anomaly. *Science,* 324(5923): 78–80.

U.S. Census Bureau. (2006). United States census, 2000. U.S. Department of Commerce, Washington, DC. From http://www.census.gov/

Vander Lee, B.; R. Smith; and J. Bates. (2006). Ecological and biological diversity of the Apache-Sitgreaves National Forests (Chapter 7). In: Ecological and biological diversity of National Forests in Southwestern Region. Southwest Forest Assessment Project. The Nature Conservancy, Tucson, AZ.

Westerling, A.L.; H.G. Hildalgo; and T.W. Swetnam. (2006). Warming and earlier spring increase western U.S. Forest wildfire activity. *Science,* 313: 940–943.

Whitlock, C. (2008). Turning up the heat...on a bubbling cauldron of forest threats. *Compass,* 10: 27–28.

Williams, J.E.; and J.M. Carter. (2009). Managing native trout past peak water. *Southwest Hydrology,* 8(2): 26–34.

Specific Web Sites:

American Communities Survey (2009), from http://factfinder.census.gov/

Climate Assessment for the Southwest (CLIMAS), from http://www.climas.arizona.edu/

Intergovernmental Panel on Climate Change (IPCC), from http://www.ipcc.ch/

NatureServe 2007, 2008, 2009, from http://www.natureserve.org

Past Global Change Web Page (PAGES) from http://www.pages.unibe.ch/

Pew Center on Global Climate Change, from http://www.pewclimate.org/

The Southwest Climate Change Network, from http://www.southwestclimatechange.org/climate/southwest/

The Western Regional Climate Center, from http://www.wrcc.dri.edu/

The Consortium for Integrated Climate Research in Western Mountains (CIRMOUNT), from http://www.fs.fed.us/psw/cirmount/

The Nature Conservancy Climate Wizard, from http://www.climatewizard.org/

USGCRP-US Global Change Research Program, from http://www.usgcrp.gov/usgcrp/default.php/

U.S. Forest Service Climate Change Resource Center, from http://www.fs.fed.us/ccrc/

Appendix B. Vegetation Conditions and Management Practices

This appendix describes the current (2011) and desired structural future conditions for the 14 major PNVTs on the forests and provides a graphic representation of age classes and an expanded description of old growth. It also describes the management practices that may be used to obtain those conditions.

Forestwide Vegetation Conditions

PNVTs

The Apache-Sitgreaves NFs can be divided into 14 major PNVTs (potential natural vegetation types) (see table 13 below). PNVTs are coarse-scale groupings of ecosystem types that share similar geography, vegetation, and historic ecosystem disturbances such as fire, drought, and grazing by native species. PNVTs represent the vegetation type and characteristics that would occur when natural disturbance regimes and biological processes prevail. It is important not to confuse PNVTs with existing vegetation types. The PNVT mapping (located in the Apache-Sitgreaves NFs' GIS database) was derived from the forests' terrestrial ecosystem survey mapping. This mapping is intended to be used for mid- and landscape-scale planning. It is important to validate the PNVTs at the project and activity level.

Table 13. Apache-Sitgreaves NFs' PNVTs and NFS acres

PNVT[a]	Size (acres)
Wetland/cienega riparian areas	17,900
Montane willow riparian forest	4,808
Cottonwood-willow riparian forest	15,876
Mixed broadleaf deciduous riparian forest	9,657
Ponderosa pine forest	602,206
Dry mixed conifer forest	147,885
Wet mixed conifer forest	177,995
Spruce-fir forest	17,667
Madrean pine-oak woodland	394,927
Piñon-juniper woodland	222,166
Semi-desert grassland	106,952
Great Basin grassland	185,523
Montane/subalpine grasslands	51,559
Interior chaparral	55,981

[a] Water, urban, and quarry account for 4,250 acres. Total Apache-Sitgreaves NFs land is 2,015,352 acres.

The following charts depict the current (based on data derived in 2011) and desired future conditions for each of the forests' PNVTs at a forestwide level[1]. Different combinations of vegetation state percentages may exist at the project or activity level. Based on site-specific conditions and capabilities, the expectation is that some projects would move certain vegetation states toward desired percentages more than other projects; collectively, they would move toward desired percentages shown at the forestwide level. This information will be useful to measure progress toward desired vegetation conditions across the entire Apache-Sitgreaves NFs over time.

Wetland/Cienega Riparian Areas

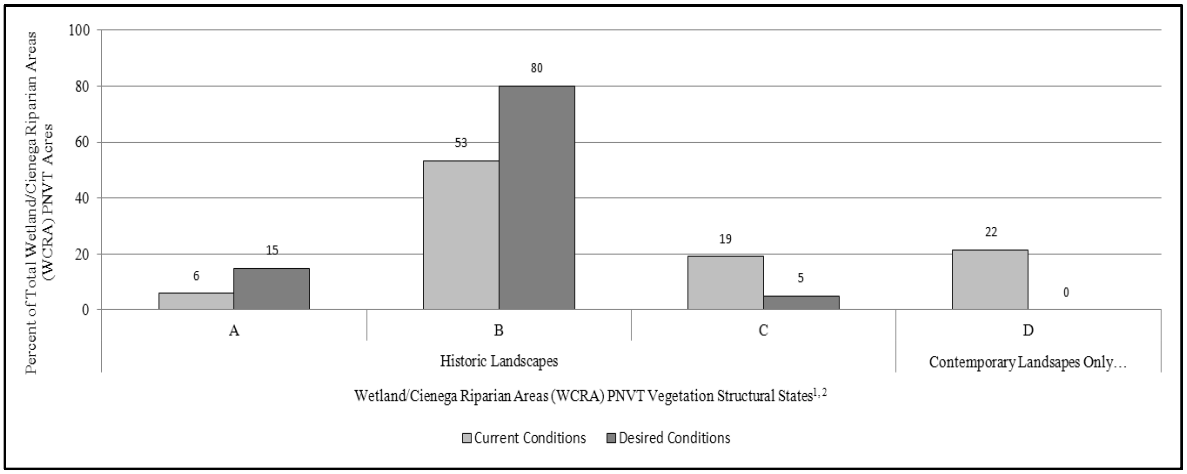

Figure 13. Wetland/Cienega Riparian Areas Woody Overstory Vegetation Condition

The figure above depicts the wetland/cienega riparian areas PNVT woody overstory vegetation structural states. At 17,900 acres (approximately 0.9 percent of the forests), this PNVT ranks 10th in size out of the 14 PNVTs on the Apache-Sitgreaves NFs. The vegetation structural states are

> State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10 percent tree or shrub canopy cover; early successional development
>
> State B - Perennial herbaceous vegetation, with < 10 percent tree or shrub canopy cover; mid successional development
>
> State C - Shrubs, and seedling and sapling size (< 5″ diameter) trees with open (< 30 percent) or closed (≥ 30) canopy cover, with perennial herbaceous vegetation understory; mid successional development
>
> State D - Shrubs, small size (5–9.9" diameter), medium size (10–19.9" diameter), and large to very large size (> 20" diameter) trees with open (< 30 percent) or closed (≥ 30) canopy cover, with herbaceous vegetation understory; late successional development; not part of the historic conditions or within historic range of variability, found on contemporary landscapes only.

The wetland/cienega riparian areas PNVT has a 36 percent or low departure rating from desired conditions and reference conditions making it the 7th and 9th most departed PNVT, respectively,

[1] Percentages shown on the graphs for each structural state are rounded to the nearest whole number. Consequently, in some cases, the total percentage for all structural states may add up to slightly more than 100.

on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference condition was derived from LANDFIRE (2003).

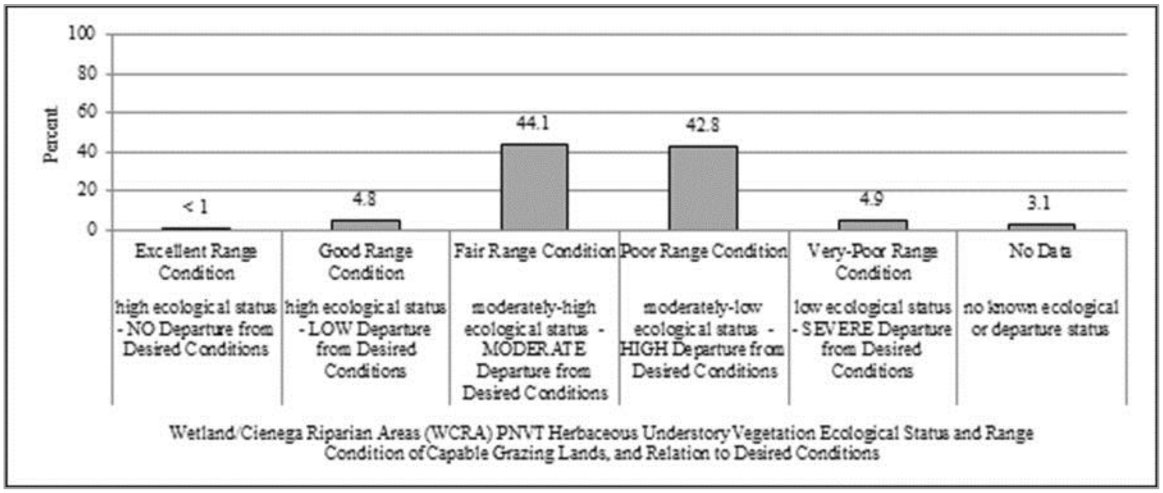

Figure 14. Wetland/Cienega Riparian Areas Herbaceous Understory Vegetation Condition

The figure above depicts the wetland/cienega riparian areas PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting

---

[2] Ecological status is the degree of similarity between the existing vegetation (all components and their characteristics) and existing soil conditions when compared to the potential natural plant community and the desired soil condition on a site. The present state of a TES map unit stated in terms of specific values or potentials with respect to species composition, ground cover, and soil characteristics. Ecological status is often evaluated on the basis of similarity indices between current conditions and the potential natural plant community (Forest Service, 1999). Ecological status ratings are high, moderately-high, moderate-low, and low (FSH 2209.21, Southwestern Region).

[3] Range condition is the present state of vegetation of a range site in relation to the climax (potential natural) plant community for that site. It is an expression of the relative degree to which the kinds, proportions, and amounts of plants in a plant community resemble that of the climax plant community for the site (Forest Service, 1999). The adjective descriptions of range condition are excellent, good, fair, poor, and very-poor (FSH 2209.21, Southwestern Region). According to Holechek et al. (1989), range condition is measured in degrees of departure from climax; excellent range condition would represent climax and very-poor range condition would represent the greatest departure from climax. The relationship between ecological status and range condition are excellent and good range condition represents high ecological status, signifying no or low departure from desired conditions; fair range condition represents moderately-high ecological status, signifying moderate departure from desired conditions; poor range condition represents moderately-low ecological status, signifying high departure from desired conditions; and very-poor range conditions represent low ecological status, signifying severe departure from desired conditions.

Range condition, as evaluated and ranked by the Forest Service, is a subjective expression of the status or health of the vegetation and soil relative to the combined potential to produce a sound and stable biotic community. Soundness and stability are evaluated relative to a standard that encompasses the composition, density, and vigor of the vegetation and physical characteristics of the soil (FSH 2209.21.40, Southwestern Region Supplement, page 3 of 46). Although the *Allotment Analysis Handbook* (FSH 2209.21, Southwestern Region) was officially removed from the directive system, this definition is used because the above information was derived (collected, calculated, and evaluated) using the procedures outlined in the FSH 2209.21, Southwestern Region Supplement, over a number of years.

livestock grazing and departure from desired conditions. Roughly 48 percent of capable grazing lands do not meet desired conditions.

Montane Willow Riparian Forest

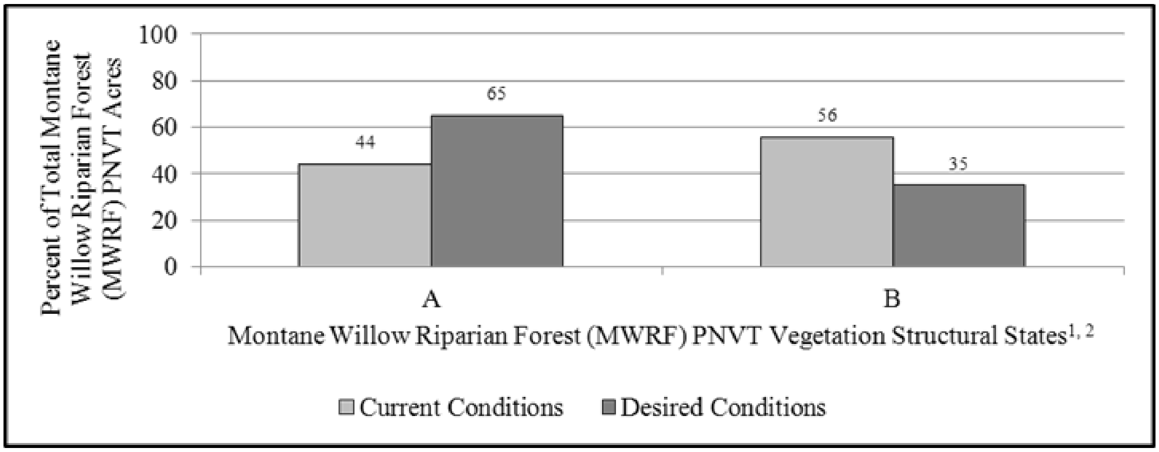

Figure 15. Montane Willow Riparian Forest Overstory Vegetation Condition

The figure above depicts the montane willow riparian forested PNVT overstory vegetation structural states. At 4,808 acres (approximately 0.2 percent of the forests), this PNVT is the smallest on the Apache-Sitgreaves NFs. The vegetation structural states are

> State A - Herbaceous vegetation regeneration, recently burned, and shrubs, and seedling and sapling size (< 5" diameter) trees with open (< 30 percent) canopy cover; early successional development.

---

[4] According to the Forest Service (1999), capable areas are fully capable areas plus potentially capable areas. Fully capable areas are those areas which can be used by grazing animals under proper management without long term damage to the soil resource or plant communities. Typically, this land is stable for livestock grazing. Vegetative ground cover is maintaining site productivity and producing a minimum of 100 pounds of dried forage per acre per year. Soil loss, as judged by available techniques, is within tolerance levels. Potentially capable areas are those areas which could be used by grazing animals under proper management but where soil stability is impaired or range developments are not adequate under existing conditions to obtain necessary grazing animal distribution. These areas are not capable of being fully or adequately utilized by grazing animals. Generally, these areas have impaired soil stability, lack of water, steep terrain, and lack of access and/or there is insufficient vegetative ground cover to protect the soil, but if treated, developed, or properly managed, could be reclassified as fully capable. An example of potentially capable range is heavily timbered or woodland areas where the tree canopy cover exceeds natural conditions and the area is producing very little forage as a result of that condition. With silvicultural treatment to return to natural fire cycle conditions, areas presently classified as potentially capable may be returned and sustained as fully capable areas. Timbered areas in potentially capable condition may have sufficient cover and litter to protect the soil. Woodland areas may or may not have sufficient cover and litter to protect the soil. Usually, land in this category producing less than 100 pounds of dried forage per acre per year is considered potentially capable until the forested or woodland stand is opened up. Transitional range created by silvicultural treatments will not be allocated for ungulate grazing on a term basis. It should only be considered as surplus forage for a short period of time and dealt with on an annual basis. When determining grazing capacity in the potentially capable class, assignments of conservative allowable use of the forage resource must be made. Rationale for assigned allowable forage use levels will be documented. Where fully capable range is isolated by potentially capable or no capability range, allowable use should be set and managed at zero because access to them may cause accelerated erosion in potentially capable or no capability areas (Forest Service, 1999).

State B - Shrubs, seedling and sapling, small size (5–9.9" diameter) trees with closed (≥ 30 percent) canopy cover, and medium size (10–19.9" diameter), and large to very large (> 20" diameter) size trees with open or closed canopy cover; mid- to late-successional development.

The montane willow riparian forested PNVT has a 21 percent or low departure rating from desired conditions and reference conditions making it the 10th and 12th most departed PNVT, respectively, on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference conditions were derived from LANDFIRE (2007e).

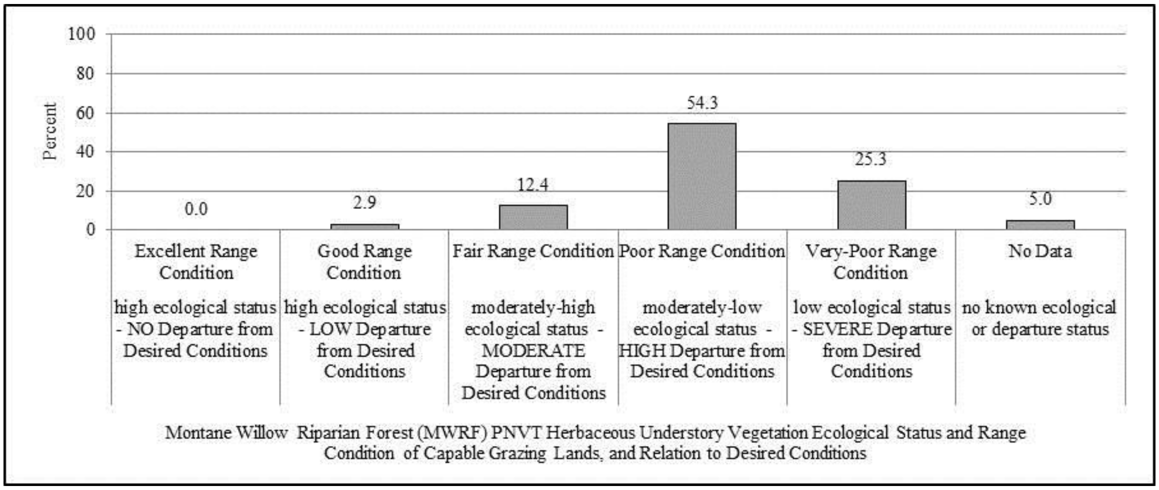

Figure 16. Montane Willow Riparian Forest Herbaceous Understory Vegetation Condition

The figure above depicts the montane willow riparian forested PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting livestock grazing and departure from desired conditions. Roughly 80 percent the capable grazing lands do not meet desired conditions.

Cottonwood-Willow Riparian Forest

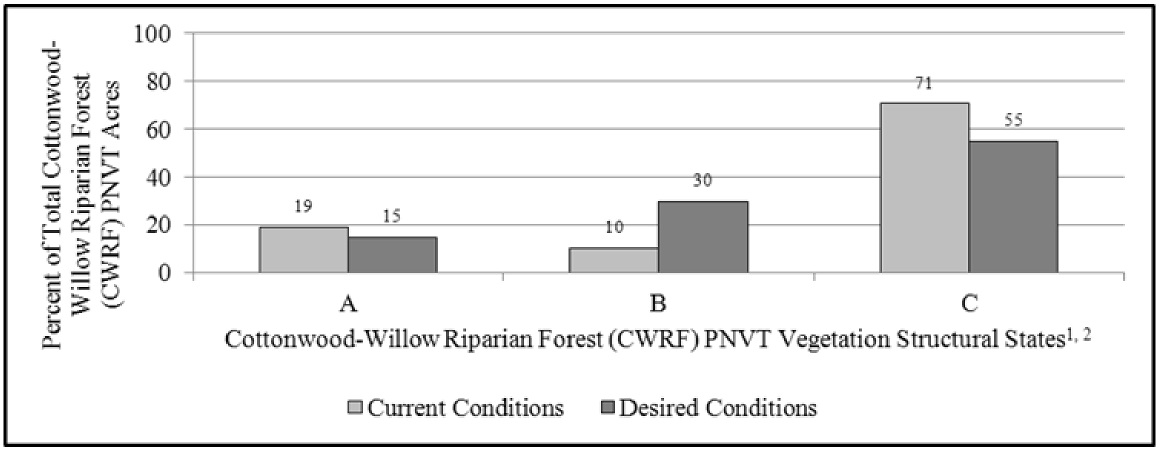

Figure 17. Cottonwood-Willow Riparian Forest Overstory Vegetation Condition

The figure above depicts the cottonwood-willow riparian forested PNVT overstory vegetation structural states. At 15,876 acres (approximately 0.8 percent of the forests), this PNVT ranks 12th in size out of the 14 PNVTs on the Apache-Sitgreaves NFs. The vegetation structural states are

> State A - Herbaceous vegetation dominated with shrubs, seedling and sapling size (< 5" diameter) trees with open (< 30 percent) or closed (≥ 30 percent) canopy cover; early successional development.
>
> State B - Tall shrubs and small size (5–9.9" diameter) trees with open or closed canopy cover; mid successional development.
>
> State C - Medium size (10–19.9" diameter) and large to very large (> 20" diameter) size trees with open or closed canopy cover; late successional development.

The cottonwood-willow riparian forested PNVT has a 20 percent or no departure rating from desired conditions and reference conditions making it the 11th and 13th most departed PNVT, respectively, on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference conditions were derived from LANDFIRE (2007d).

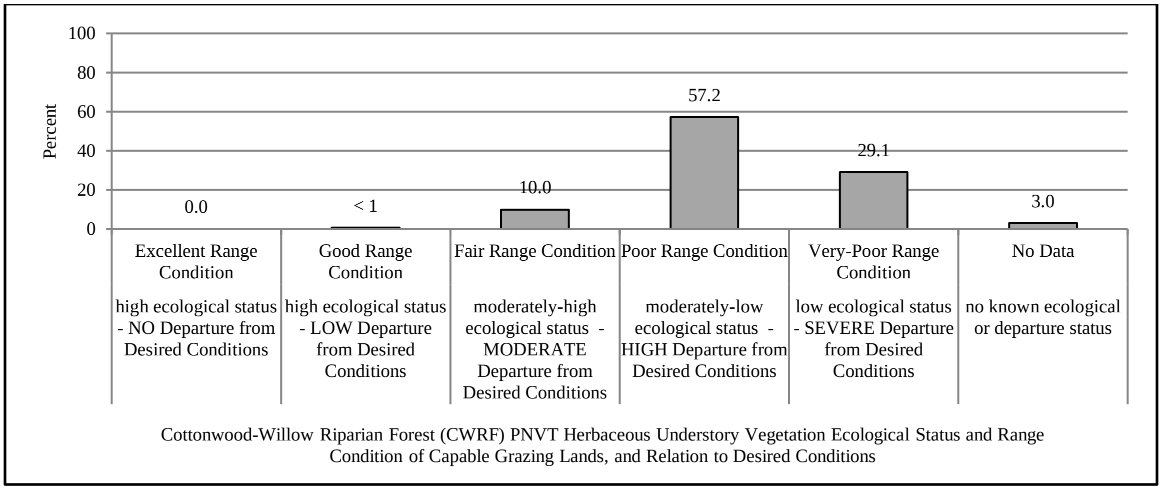

Figure 18. Cottonwood-Willow Riparian Forest Herbaceous Understory Vegetation Condition

The figure above depicts the cottonwood-willow riparian forested PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting livestock grazing and departure from desired conditions. Roughly 86 percent of the capable grazing lands do not meet desired conditions.

Mixed Broadleaf Deciduous Riparian Forest

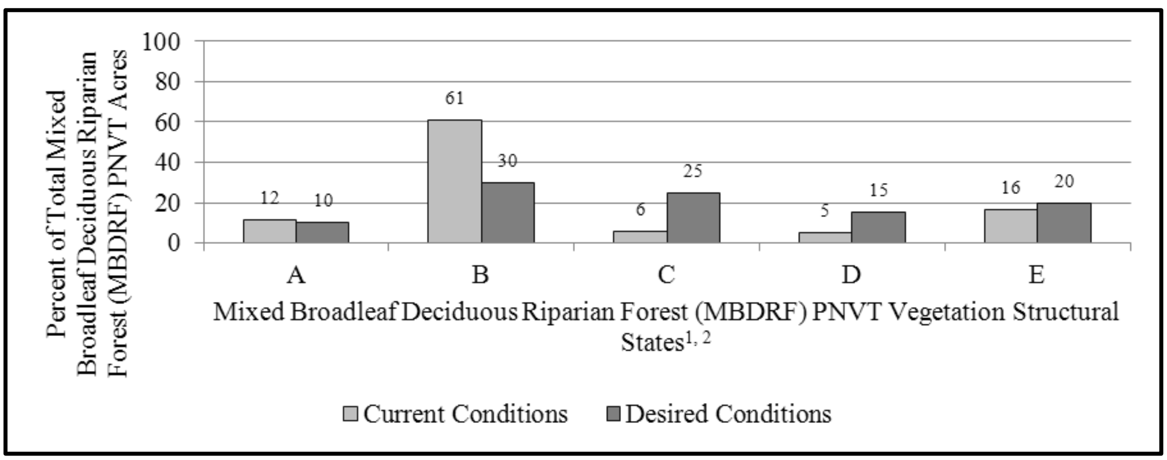

Figure 19. Mixed Broadleaf Deciduous Riparian Forest Overstory Vegetation Condition

The figure above depicts the mixed broadleaf deciduous riparian forested PNVT overstory vegetation structural states. At 9,657 acres (approximately 0.5 percent of the forests), this PNVT ranks 13th in size out of the 14 PNVTs on the Apache-Sitgreaves NFs. The vegetation structural states are

> State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10 percent tree or shrub canopy cover; early successional development

State B - Shrubs, seedling and sapling size (< 5" diameter), small size (5–9.9" diameter), and medium size (10–19.9" diameter) trees with closed (> 30 percent) canopy cover; mid-successional development.

State C - Shrubs, seedling and sapling, and small size trees with open (< 30 percent) canopy cover; mid-successional development.

State D - Shrubs, medium size, and large to very large size (> 20" diameter) trees with open canopy cover; late successional development.

State E - Shrubs, and large to very large size trees with closed canopy cover; late successional development.

The mixed broadleaf deciduous riparian forested PNVT has a 33 percent or low departure rating from desired conditions and reference conditions making it the 8th and 9th most departed PNVT, respectively, on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference conditions were derived from LANDFIRE (2007d).

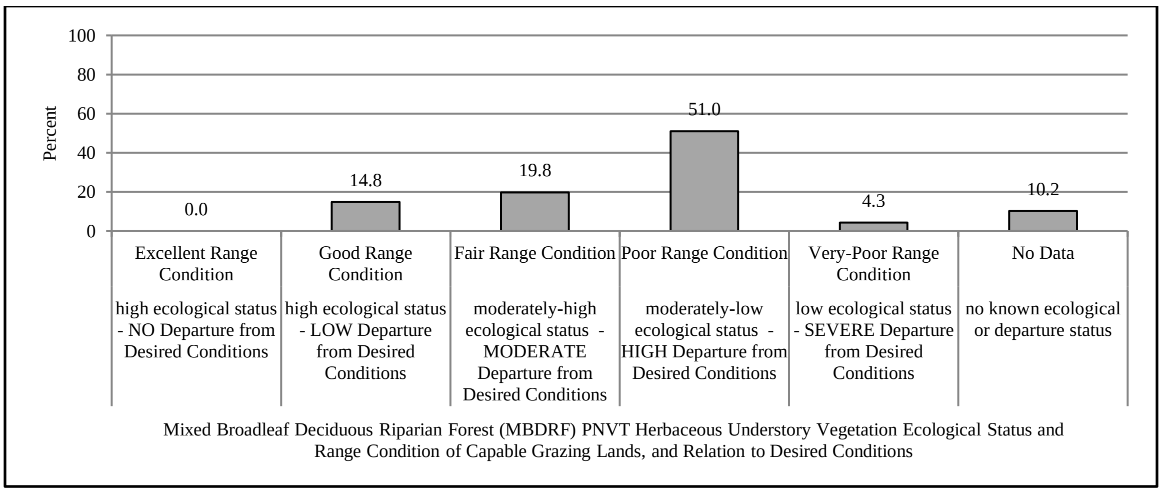

Figure 20. Mixed Broadleaf Deciduous Riparian Forest Herbaceous Understory Vegetation Condition

The figure above depicts the mixed broadleaf deciduous riparian forested PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting livestock grazing and departure from desired conditions. Roughly 54 percent of the capable grazing lands do not meet desired conditions.

Ponderosa Pine Forest

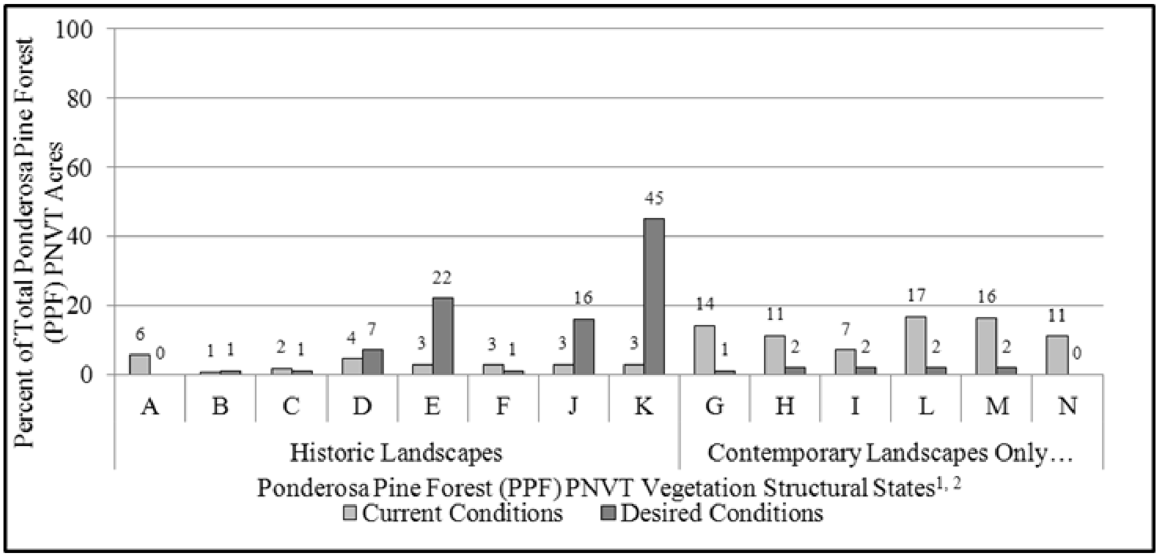

Figure 21. Ponderosa Pine Forest Overstory Vegetation Condition

The figure above depicts the ponderosa pine forested PNVT overstory vegetation structural states. At 602,206 acres (approximately 30 percent of the forests), this PNVT is the largest on the Apache-Sitgreaves NFs. The vegetation structural states are

State A - Recently burned, grass, forb and shrub types with < 10 percent tree canopy cover; early successional development.

State B - Seedling and sapling size (< 5" diameter) trees with open (< 30 percent) canopy cover; all tree types; early successional development.

State C - Small size (5–9.9" diameter) trees, with open canopy cover; all tree types; mid-successional development.

State D - Medium size (10–19.9" diameter) trees, single storied, with open canopy cover; all tree types; late successional development.

State E - Large to very large size (≥ 20" diameter) trees, single storied, with open canopy cover; all tree types; late successional development.

State F - Seedling and sapling size trees with closed (≥ 30 percent) canopy cover; all tree types; early successional development.

State G - Small size trees, with closed canopy cover; all tree types; mid-successional development; not part of the reference condition, found on contemporary landscapes only.

State H - Medium size trees, single storied, with closed canopy cover; all shade tree types; late successional development; not part of the reference condition, found on contemporary landscapes only.

State I - Large to very large size trees, single storied, with closed canopy cover; all tree types; late successional development; not part of the reference condition, found on contemporary landscapes only.

State J - Medium size trees, multistoried, with open canopy cover; all tree types; late successional development.

State K - Large to very large size trees, multistoried, with open canopy cover; all tree types; late successional development.

State L - Medium size trees, multistoried, with closed canopy cover; all tree types; late successional development; not part of the reference condition, found on contemporary landscapes only.

State M - Large to very large size trees, multistoried, with closed canopy cover; tree types; late successional development; not part of the reference condition, found on contemporary landscapes only.

State N - Recently burned, grass, forb, and shrub types with < 10 percent tree canopy cover; uncharacteristic early successional development due to fire; not part of the reference condition, found on contemporary landscapes only.

The ponderosa pine forested PNVT has a 77 percent or high departure rating from desired conditions and a 94 percent or severe departure rating from reference conditions making it the 2nd and 1st most departed PNVT, respectively, on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference conditions were derived from the Nature Conservancy (Smith, 2006a).

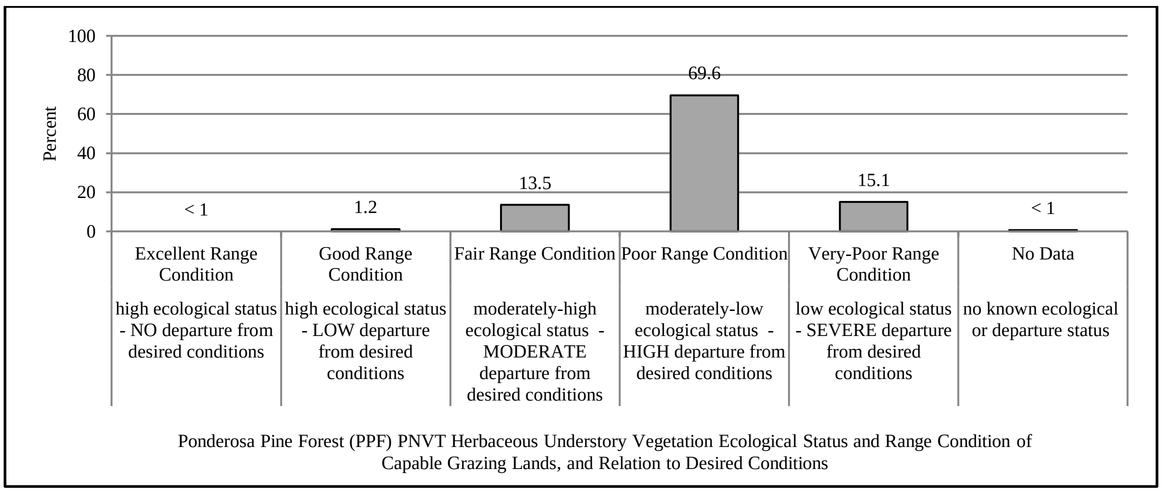

Figure 22. Ponderosa Pine Forest Herbaceous Understory Vegetation Condition

The figure above depicts the ponderosa pine forested PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting livestock grazing and departure from desired conditions. Roughly 85 percent of capable grazing lands do not meet desired conditions.

Dry Mixed Conifer Forest

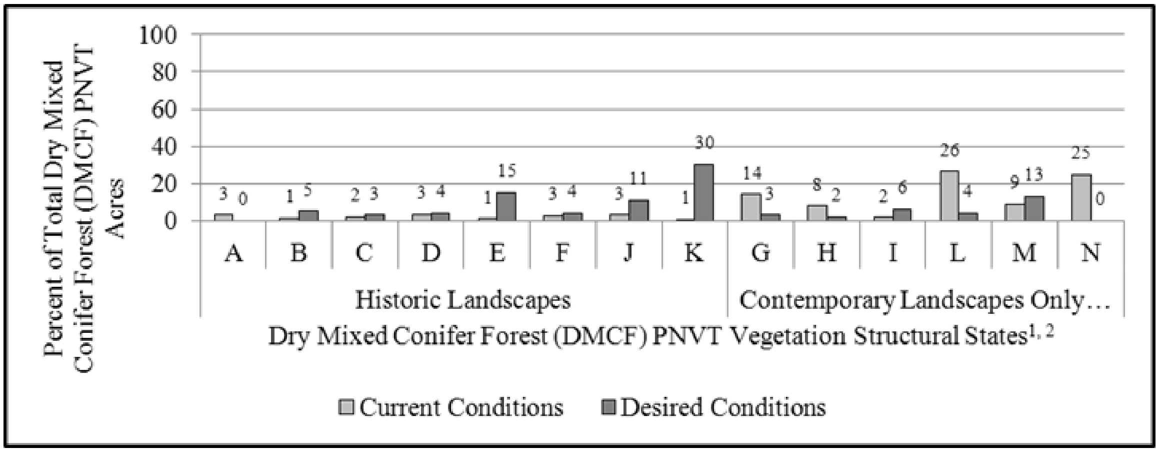

Figure 23. Dry Mixed Conifer Forest Overstory Vegetation Condition

The figure above depicts the dry mixed conifer forested PNVT overstory vegetation structural states. At 147,885 acres (approximately 7 percent of the forests), this PNVT ranks 6th in size out of the 14 PNVTs on the Apache-Sitgreaves NFs. The vegetation structural states are

State A - Recently burned, grass, forb and shrub types with < 10 percent tree canopy cover; early successional development.

State B - Seedling and sapling size (< 5" diameter) trees with open (< 30 percent) canopy cover; all tree types; early successional development.

State C - Small size (5–9.9" diameter) trees, with open canopy cover; all tree types; mid-successional development.

State D - Medium size (10–19.9" diameter) trees, single storied, with open canopy cover; all tree types; late successional development.

State E - Large to very large size (≥ 20" diameter) trees, single storied, with open canopy cover; all tree types; late successional development.

State F - Seedling and sapling size trees with closed (≥ 30 percent) canopy cover; all tree types; early successional development.

State G - Small size trees, with closed canopy cover; all tree types; mid-successional development; not part of the reference condition, found on contemporary landscapes only.

State H - Medium size trees, single storied, with closed canopy cover; all shade tree types; late successional development; not part of the reference condition, found on contemporary landscapes only.

State I - Large to very large size trees, single storied, with closed canopy cover; all tree types; late successional development; not part of the reference condition, found on contemporary landscapes only.

State J - Medium size trees, multistoried, with open canopy cover; all tree types; late successional development.

State K - Large to very large size trees, multistoried, with open canopy cover; all tree types; late successional development.

State L - Medium size trees, multistoried, with closed canopy cover; all tree types; late successional development; not part of the reference condition, found on contemporary landscapes only.

State M - Large to very large size trees, multistoried, with closed canopy cover; tree types; late successional development; not part of the reference condition, found on contemporary landscapes only.

State N - Recently burned, grass, forb, and shrub types with < 10 percent tree canopy cover; uncharacteristic early successional development due to fire; not part of the reference condition, found on contemporary landscapes only.

The dry mixed conifer forested PNVT has a 67 percent or high departure rating from desired conditions and a 77 percent or high departure rating from reference conditions making it tied with Great Basin grassland for the 3rd most departed PNVT from desired conditions and 3rd most departed PNVT from reference conditions on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference conditions were derived from LANDFIRE (2007a).

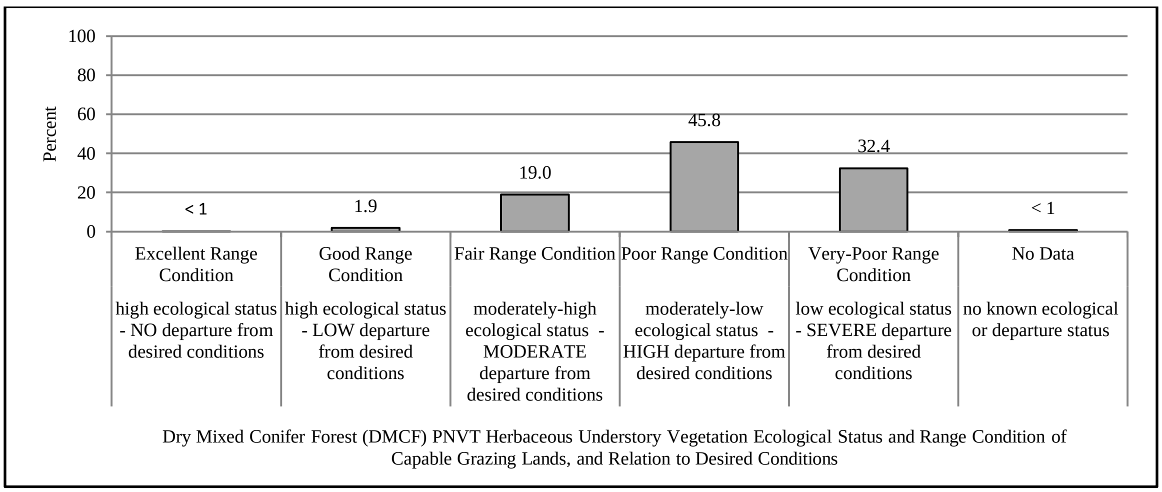

Figure 24. Dry Mixed Conifer Forest Herbaceous Understory Vegetation Condition

The figure above depicts the dry mixed conifer forested PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting livestock grazing and departure from desired conditions. Roughly 78 percent of capable grazing lands do not meet desired conditions.

Wet Mixed Conifer Forest

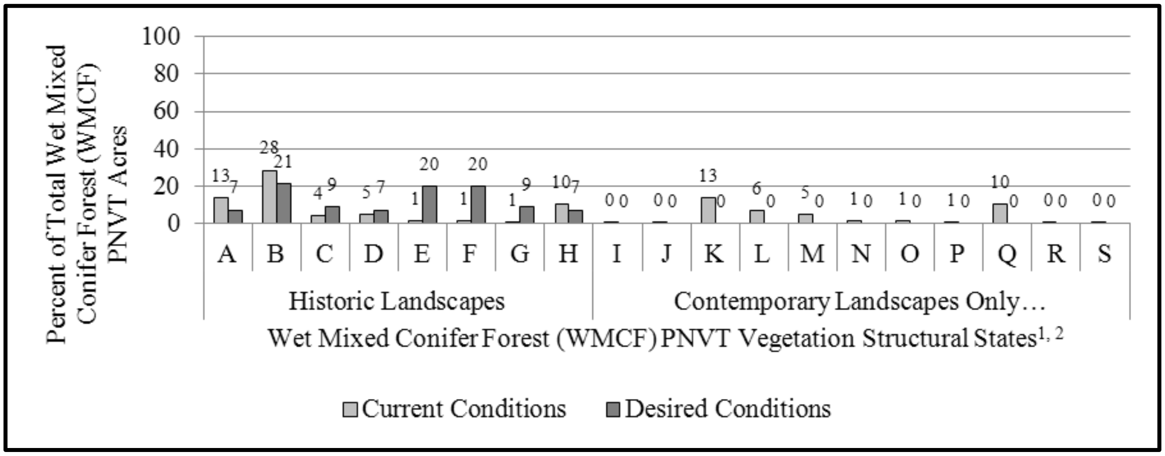

Figure 25. Wet Mixed Conifer Forest Overstory Vegetation Condition

The figure above depicts the wet mixed conifer forested PNVT overstory vegetation structural states. At 177,995 acres (approximately 9 percent of the forests), this PNVT ranks 5th in size out of the 14 PNVTs on the Apache-Sitgreaves NFs. The vegetation structural states are

State A - Recently burned, grass, forb and shrub types, with < 10 percent tree canopy cover; early successional development with aspen regeneration.

State B - Seedling and sapling (< 5" diameter), small (5–9.9" diameter), medium (10–19.9" diameter), large to very large (≥ 20" diameter) size trees, with open (> 10 percent and ≤ 30 percent) or closed (> 30 percent) canopy cover, consisting of all aspen, deciduous tree mix, and evergreen-deciduous mix tree types; with a plurality of shade intolerant tree types.

State C - Seedling and sapling, and small size trees, with open or closed canopy cover; with a plurality of shade tolerant tree types.

State D - Medium size trees, single or multistoried, with open or closed canopy cover; with a plurality of mixed shade tolerant tree types; with aspen regeneration.

State E - Large to very large size trees, single storied, with closed canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration.

State F - Large to very large size trees, multistoried, with closed canopy cover; with a plurality of mixed shade tolerant tree types; with aspen regeneration.

State G - Seedling and sapling, and small size trees, with open canopy cover; shade intolerant tree types; with aspen regeneration.

State H - Medium size trees, single or multistoried, with open or closed canopy cover; with a plurality of mixed shade tolerant tree types.

State I - Large to very large size trees, single storied, with open canopy cover; with a plurality of shade tolerant tree types; not part of the reference condition, found on contemporary landscapes only.

State J - Large to very large size trees, multistoried, with open canopy cover; with a plurality of shade tolerant tree types; not part of the reference condition, found on contemporary landscapes only.

State K - Recently burned, grass, forb and shrub types, with < 10 percent tree canopy cover; early successional development; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State L - Seedling and sapling, and small size trees, with closed canopy cover; with a plurality of mixed shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State M - Medium size trees, single or multistoried, with open or closed canopy cover; with a plurality of mixed shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State N - Large to very large size trees, single storied, with open canopy cover; with a plurality of shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State O - Large to very large size trees, multistoried, with closed canopy cover; with a plurality of mixed shade tolerant tree types; state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State P - Seedling and sapling, and small size trees, with open canopy cover; with a plurality of shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State Q - Medium size trees, single or multistoried, with open or closed canopy cover; with a plurality of shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State R - Large to very large size trees, single storied, with open canopy cover; with a plurality of mixed shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State S - Large to very large size trees, multistoried, with open canopy cover; with a plurality of shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

The wet mixed conifer forested PNVT has a 54 percent or moderate departure rating from desired conditions and a 61 percent or high departure rating from reference conditions making it tied with montane/subalpine grasslands for the 7th most departed PNVT for desired conditions and 7th most departed PNVT from reference conditions on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference conditions were derived from the Nature Conservancy (Smith, 2006b).

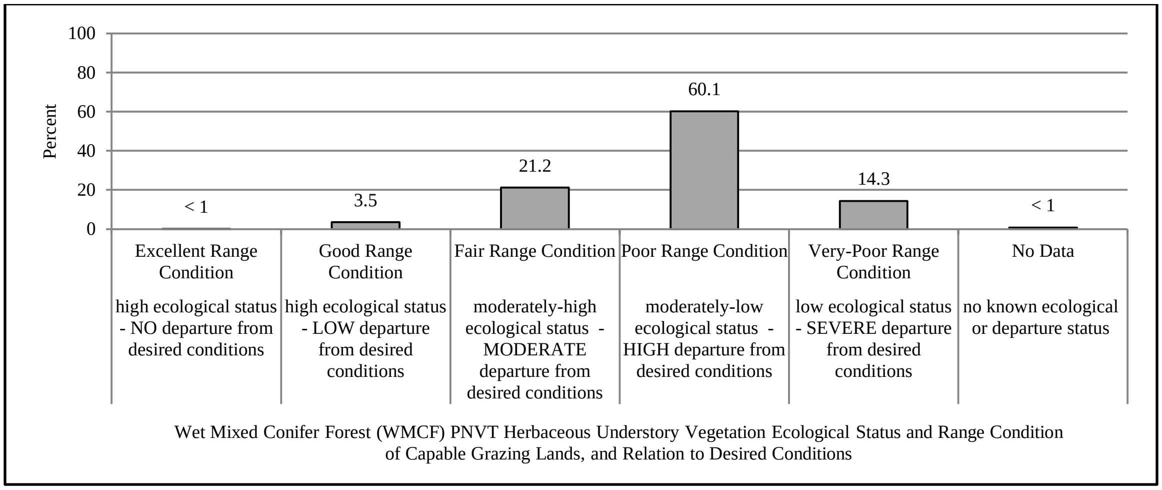

Figure 26. Wet Mixed Conifer Forest Herbaceous Understory Vegetation Condition

The figure above depicts the wet mixed conifer forested PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting livestock grazing and departure from desired conditions. Roughly 74 percent of capable grazing lands do not meet desired conditions.

Spruce-Fir Forest

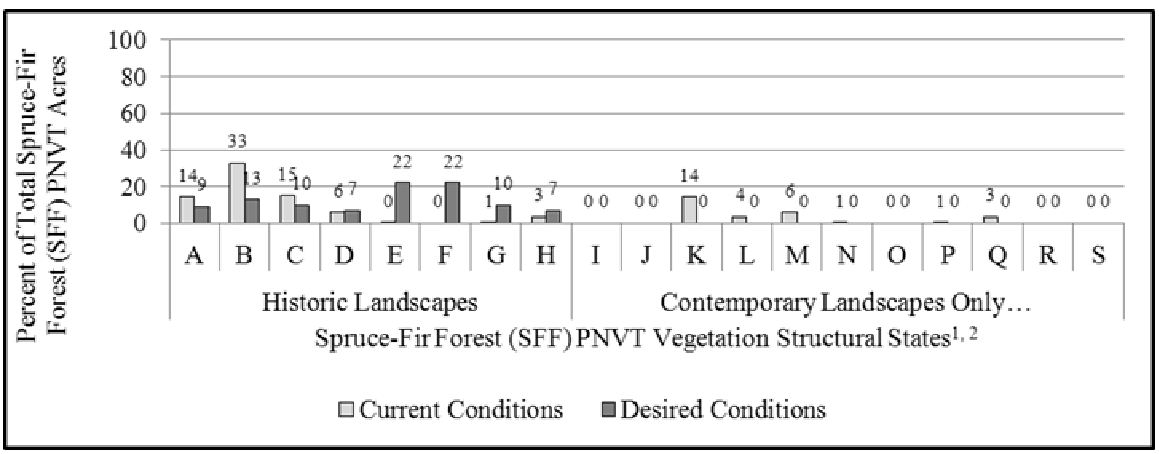

Figure 27. Spruce-Fir Forest Overstory Vegetation Condition

The figure above depicts the spruce-fir forested PNVT overstory vegetation structural states. At 17,667 acres (approximately 0.9 percent of the forests), this PNVT ranks 11th in size out of the 14 PNVTs on the Apache-Sitgreaves NFs. The vegetation structural states are

State A - Recently burned, grass, forb and shrub types, with < 10 percent tree canopy cover; early successional development with aspen regeneration.

State B - Seedling and sapling (< 5" diameter), small (5–9.9" diameter), medium (10–19.9" diameter), large to very large (≥ 20" diameter) size trees, with open (> 10 percent and ≤ 30 percent) or closed (> 30 percent) canopy cover, consisting of all aspen, deciduous tree mix, and evergreen-deciduous mix tree types; with a plurality of shade intolerant tree types.

State C - Seedling and sapling, and small size trees, with open or closed canopy cover; with a plurality of shade tolerant tree types.

State D - Medium size trees, single or multistoried, with open or closed canopy cover; with a plurality of mixed shade tolerant tree types; with aspen regeneration.

State E - Large to very large size trees, single storied, with closed canopy cover; with a plurality of shade tolerant tree types; with aspen regeneration.

State F - Large to very large size trees, multistoried, with closed canopy cover; with a plurality of mixed shade tolerant tree types; with aspen regeneration.

State G - Seedling and sapling, and small size trees, with open canopy cover; shade intolerant tree types; with aspen regeneration.

State H - Medium size trees, single or multistoried, with open or closed canopy cover; with a plurality of mixed shade tolerant tree types.

State I - Large to very large size trees, single storied, with open canopy cover; with a plurality of shade tolerant tree types; not part of the reference condition, found on contemporary landscapes only.

State J - Large to very large size trees, multistoried, with open canopy cover; with a plurality of shade tolerant tree types; not part of the reference condition, found on contemporary landscapes only.

State K - Recently burned, grass, forb and shrub types, with < 10 percent tree canopy cover; early successional development; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State L - Seedling and sapling, and small size trees, with closed canopy cover; with a plurality of mixed shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State M - Medium size trees, single or multistoried, with open or closed canopy cover; with a plurality of mixed shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State N - Large to very large size trees, single storied, with open canopy cover; with a plurality of shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State O - Large to very large size trees, multistoried, with closed canopy cover; with a plurality of mixed shade tolerant tree types; state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State P - Seedling and sapling, and small size trees, with open canopy cover; with a plurality of shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State Q - Medium size trees, single or multistoried, with open or closed canopy cover; with a plurality of shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State R - Large to very large size trees, single storied, with open canopy cover; with a plurality of mixed shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

State S - Large to very large size trees, multistoried, with open canopy cover; with a plurality of shade tolerant tree types; this state exists with elk and no aspen regeneration; not part of the reference condition, found on contemporary landscapes only.

The spruce-fir forested PNVT has a 59 percent or moderate departure rating from desired conditions and a 62 percent or high departure rating from reference conditions making it the 6th most departed PNVT, respectively, on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference conditions were derived from the Nature Conservancy (Smith, 2006c).

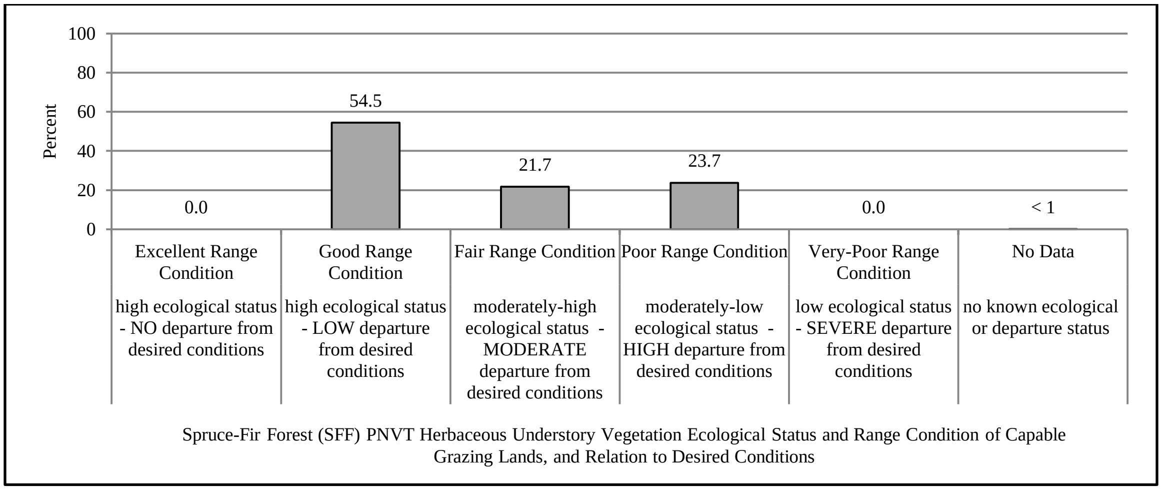

Figure 28. Spruce-Fir Forest Herbaceous Understory Vegetation Condition

The figure above depicts the spruce-fir forested PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting livestock grazing and departure from desired conditions. Roughly 24 percent of capable grazing lands do not meet desired conditions.

Madrean Pine-Oak Woodland

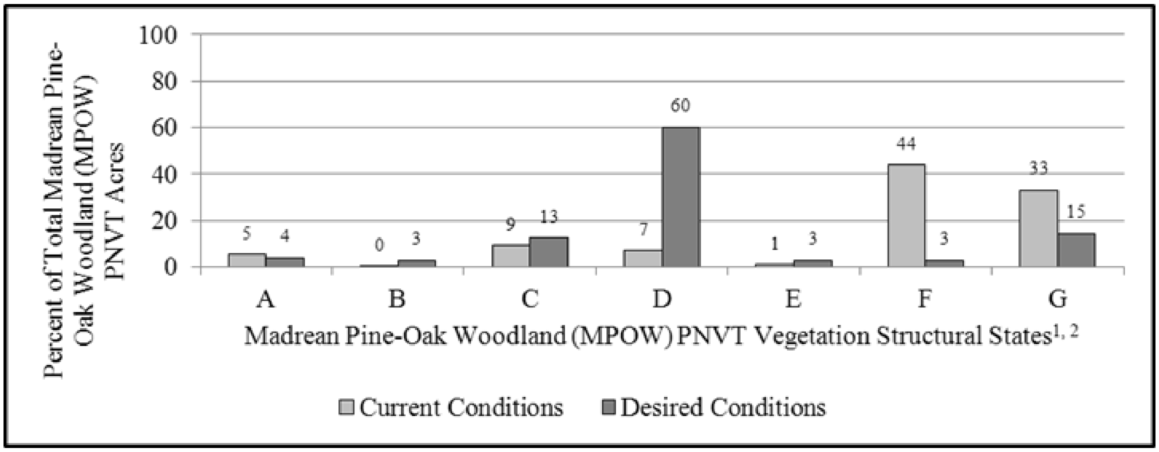

Figure 29. Madrean Pine-Oak Woodland Overstory Vegetation Condition

The figure above depicts the Madrean pine-oak woodland PNVT overstory vegetation structural states. At 394,927 acres (approximately 20 percent of the forests), this PNVT ranks 2nd in size out of the 14 PNVTs on the Apache-Sitgreaves NFs. The vegetation structural states are

State A - Recently burned, grass, forb and shrub types with < 10 percent tree canopy cover; early successional development.

State B - Seedling and sapling size (< 5" diameter) trees with open (< 30 percent) canopy cover; all tree types; early successional development.

State C - Small size (5–9.9" diameter) trees, with open canopy cover; all tree types; mid-successional development.

State D - Medium and large to very large size (≥ 10" diameter) trees, with open canopy cover; all tree types; late successional development.

State E - Seedling and sapling size trees with closed (≥ 30 percent) canopy cover; all tree types; early successional development.

State F - Small size trees, with closed canopy cover; all tree types; mid-successional development.

State G - Medium and large to very large size trees, with closed canopy cover; all tree types; late successional development.

The Madrean pine-oak woodland PNVT has a 61 percent or high departure rating from desired conditions and a 72 percent or high departure rating from reference conditions making it the 4th most departed PNVT, respectively, on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference conditions were derived from the Nature Conservancy (Schussman and Gori, 2006).

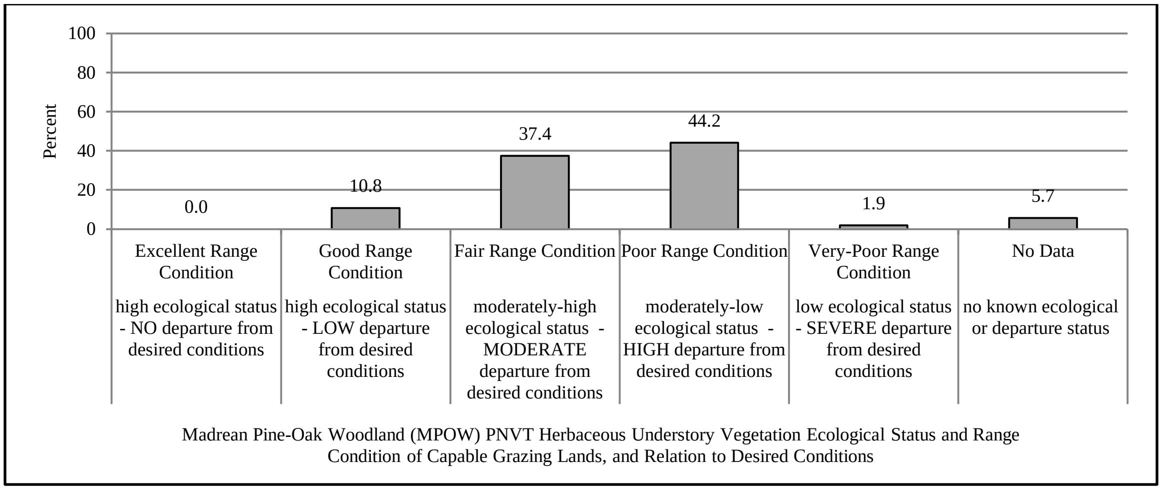

Figure 30. Madrean Pine-Oak Woodland Herbaceous Understory Vegetation Condition

The figure above depicts the Madrean pine-oak woodland PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting livestock grazing and departure from desired conditions. Roughly 46 percent of capable grazing lands do not meet desired conditions.

Piñon-Juniper Woodland

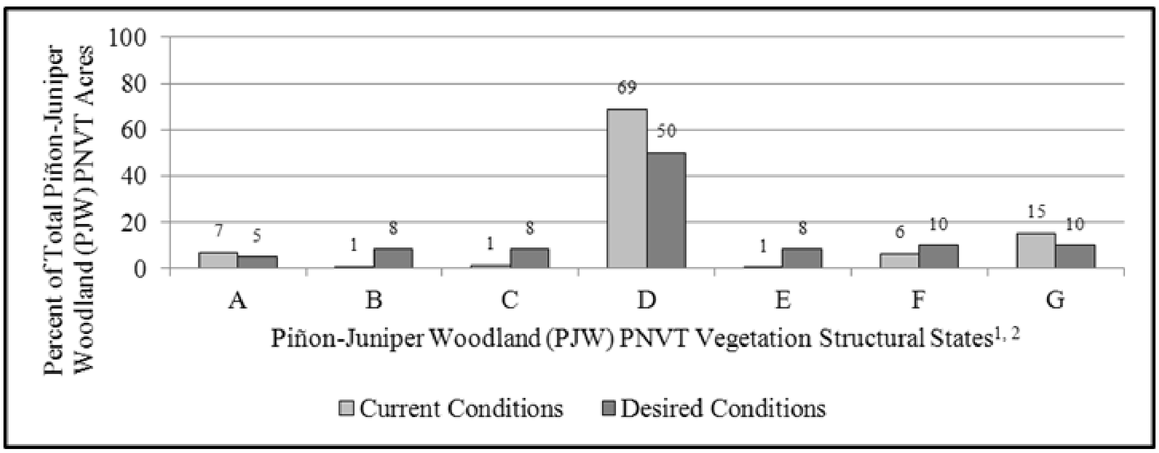

Figure 31. Piñon-Juniper Woodland Overstory Vegetation Condition

The figure above depicts the piñon-juniper woodland PNVT overstory vegetation structural states. At 222,166 acres (approximately 11 percent of the forests), this PNVT ranks 3rd in size out of the 14 PNVTs on the Apache-Sitgreaves NFs. The vegetation structural states are

State A - Recently burned, grass, forb and shrub types with < 10 percent tree canopy cover; early successional development.

State B - Seedling and sapling size (< 5" diameter) trees with open (< 30 percent) canopy cover; all tree types; early successional development.

State C - Small size (5–9.9" diameter) trees, with open canopy cover; all tree types; mid-successional development.

State D - Medium and large to very large size (≥ 10" diameter) trees, with open canopy cover; all tree types; late successional development.

State E - Seedling and sapling size trees with closed (≥ 30 percent) canopy cover; all tree types; early successional development.

State F - Small size trees, with closed canopy cover; all tree types; mid-successional development.

State G - Medium and large to very large size trees, with closed canopy cover; all tree types; late successional development.

The piñon-juniper woodland PNVT has a 28 percent or low departure rating from desired conditions and reference conditions making it the 10th and 11th most departed PNVT, respectively, on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference conditions were derived from LANDFIRE (2005).

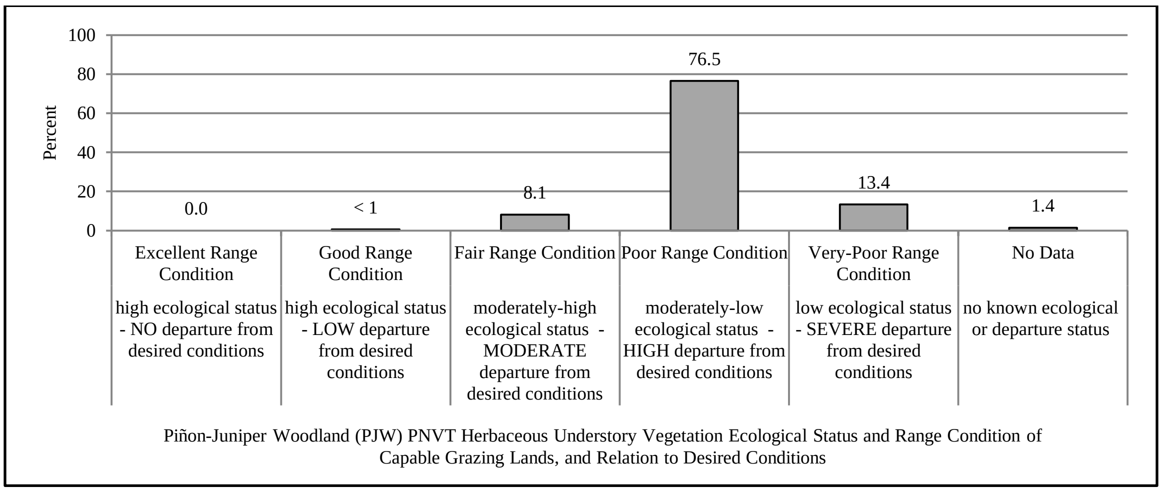

Figure 32. Piñon-Juniper Woodland Herbaceous Understory Vegetation Condition

The figure above depicts the piñon-juniper woodland PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting livestock grazing and departure from desired conditions. Roughly 91 percent of capable grazing lands do not meet desired conditions.

Semi-desert Grassland

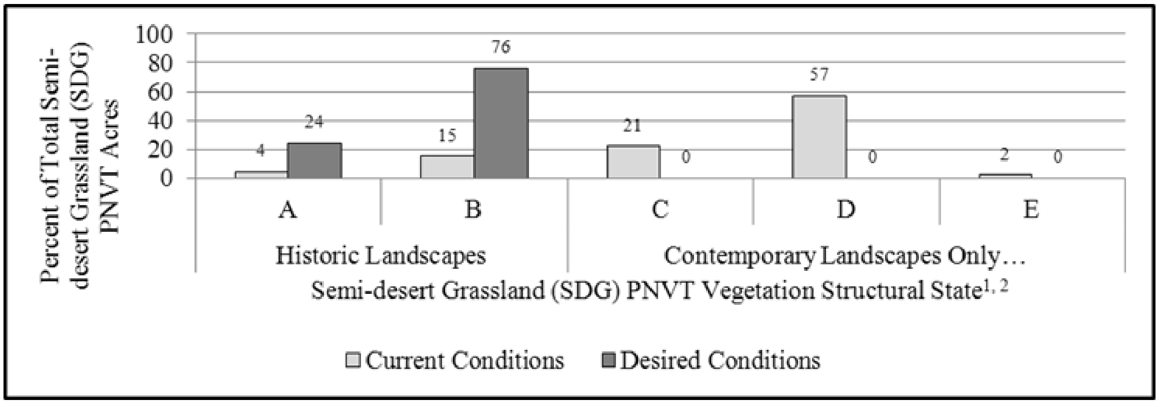

Figure 33. Semi-desert Grassland Woody Overstory Vegetation Condition

The figure above depicts the semi-desert grassland PNVT woody overstory vegetation structural states. At 106,952 acres (approximately 5 percent of the forests), this PNVT ranks 7th in size out of the 14 PNVTs on the Apache-Sitgreaves NFs. The vegetation structural states are

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10 percent tree or shrub canopy cover; early successional development.

State B - Perennial herbaceous vegetation, with < 10 percent tree or shrub canopy cover; mid-successional development.

State C - Perennial herbaceous vegetation with shrubs, seedling, and sapling size (< 5" diameter), small size (5–9.9" diameter), and medium size (10–19.9" diameter) trees with open (< 30 percent) canopy cover; late successional development; not part of the reference condition, found on contemporary landscapes only.

State D - Shrubs, seedling and sapling, small, medium, and large to very large size (> 20" diameter) trees with closed (≥ 30 percent) canopy cover, and large to very large size trees with open canopy cover with perennial herbaceous vegetation understory, mid-successional development; not part of the reference condition, found on contemporary landscapes only.

State E - Various noxious weeds and invasive nonnative plants makeup a significant portion of the herbaceous vegetation composition; not part of the reference condition, found on contemporary landscapes only.

The semi-desert grassland PNVT has a 79 percent or high departure rating from desired conditions and reference conditions making it the 1st and 2nd most departed PNVT, respectively, on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference conditions were derived from the Nature Conservancy (Schussman, 2006a).

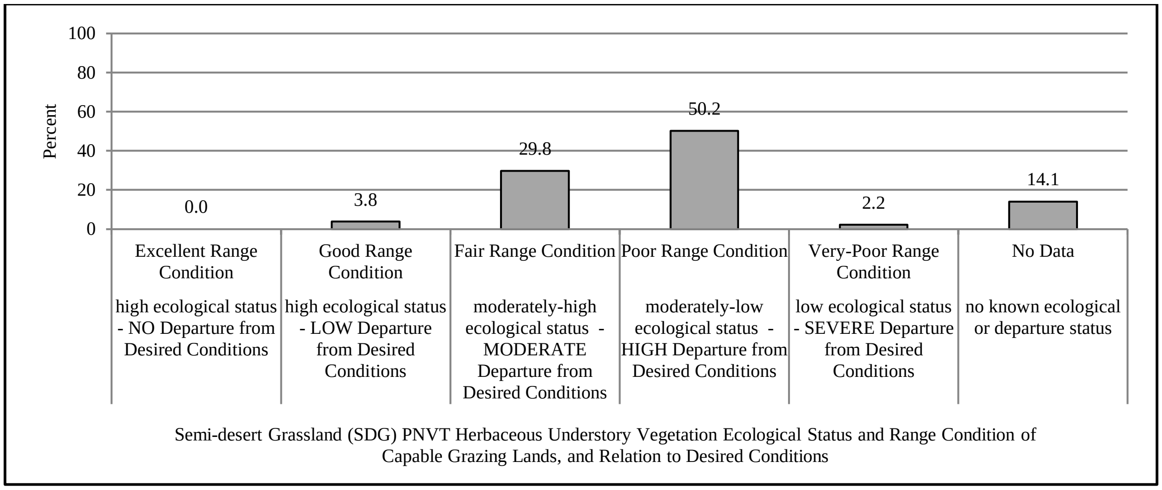

Figure 34. Semi-desert Grassland Herbaceous Understory Vegetation Condition

The figure above depicts the semi-desert grassland PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting livestock grazing and departure from desired conditions. Roughly 52 percent of capable grazing lands do not meet desired conditions.

Great Basin Grassland

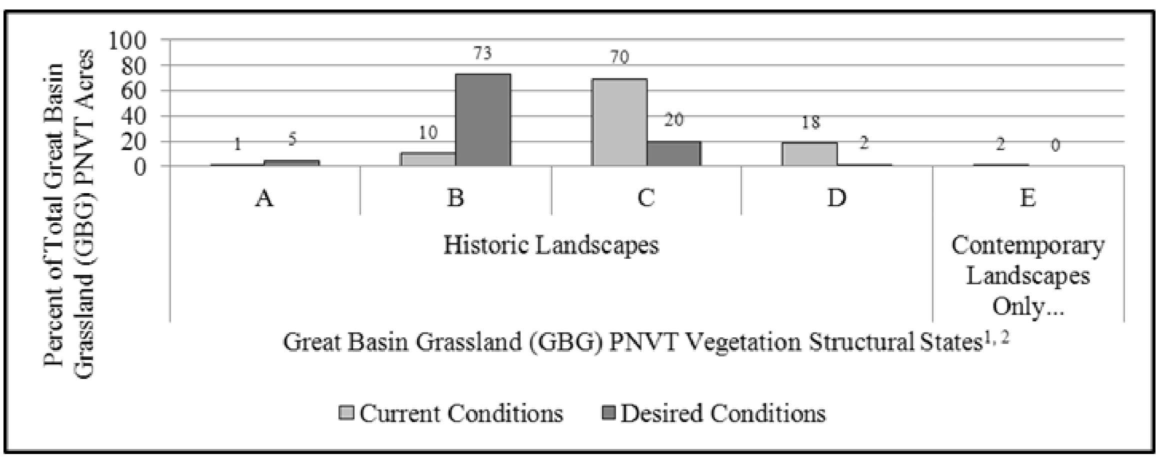

Figure 35. Great Basin Grassland Woody Overstory Vegetation Condition

The figure above depicts the Great Basin grassland PNVT woody overstory vegetation structural states. At 185,523 acres (approximately 9 percent of the forests), this PNVT ranks 4th in size out of the 14 PNVTs on the Apache-Sitgreaves NFs. The vegetation structural states are

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10 percent tree or shrub canopy cover; early successional development.

State B - Open perennial herbaceous vegetation, with < 10 percent tree or shrub canopy cover; mid-successional development.

State C - Perennial herbaceous vegetation with shrubs, seedling and sapling size (< 5" diameter), small size (5–9.9" diameter), and medium size (10–19.9" diameter) trees with open (< 30 percent) canopy cover; late successional development.

State D - Shrubs, seedling, and sapling, small, medium, and large to very large size (> 20" diameter) trees with closed (≥ 30 percent) canopy cover, and large to very large size trees with open canopy cover with perennial herbaceous vegetation understory, mid-successional development.

State E - Various noxious weeds and invasive nonnative plants makeup a significant portion of the herbaceous vegetation composition; not part of the reference condition, found on contemporary landscapes only.

The Great Basin grassland PNVT has a 67 percent or high departure rating from desired conditions and reference conditions making it tied with dry mixed conifer forest for the 3rd most departed PNVT from desired conditions and 5th most departed PNVT from reference conditions on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference conditions were derived from LANDFIRE (2007b).

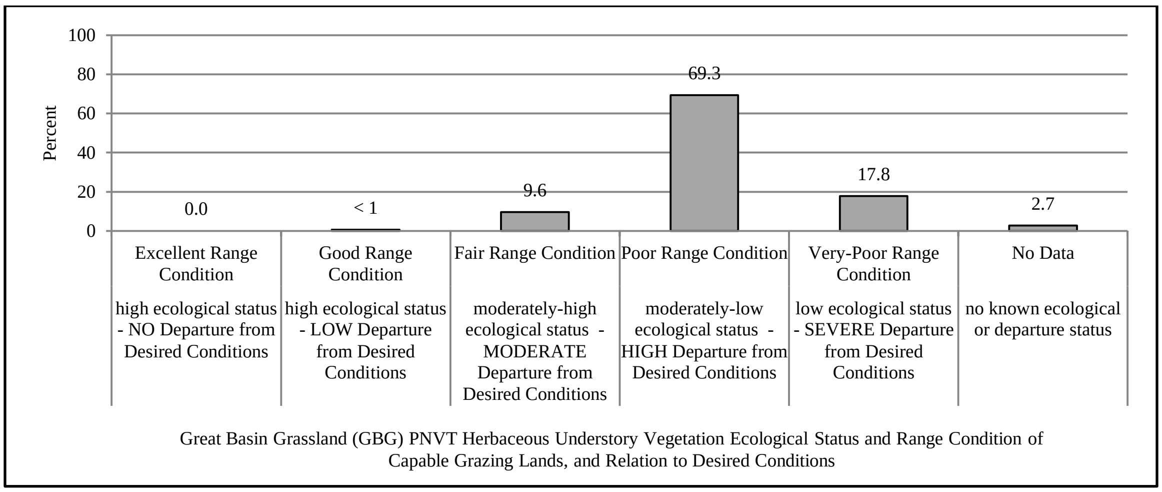

Figure 36. Great Basin Grassland Herbaceous Understory Vegetation Condition

The figure above depicts the Great Basin grassland PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting livestock grazing and departure from desired conditions. Roughly 87 percent of capable grazing lands do not meet desired conditions.

Montane/Subalpine Grasslands

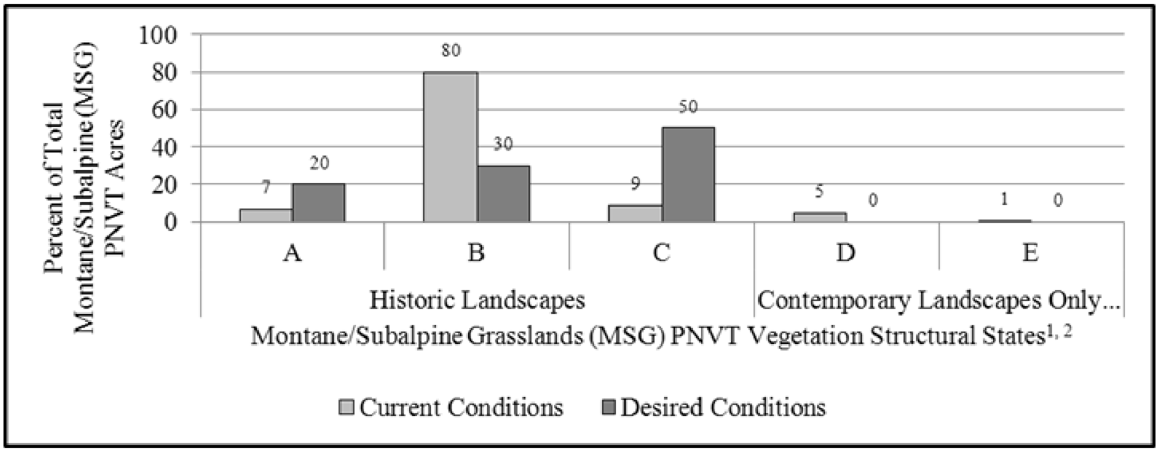

Figure 37. Montane/Subalpine Grasslands Woody Overstory Vegetation Condition

The figure above depicts the montane/subalpine grasslands PNVT woody overstory vegetation structural states. At 51,559 acres (approximately 3 percent of the forests), this PNVT ranks 9th in size out of the 14 PNVTs on the Apache-Sitgreaves NFs. The vegetation structural states are,

> State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10 percent tree or shrub canopy cover; early successional development.
>
> State B - Perennial herbaceous vegetation, with < 10 percent tree or shrub canopy cover; mid-successional development.
>
> State C - Perennial herbaceous vegetation, with < 10 percent tree or shrub canopy cover; late successional development.
>
> State D - Shrubs, seedling, and sapling size (< 5" diameter), small size (5–9.9" diameter), medium size (10–19.9" diameter), and large to very large size (> 20" diameter) trees with open (< 30 percent) or closed (≥ 30) canopy cover, with perennial herbaceous vegetation understory; not part of the reference condition, found on contemporary landscapes only.
>
> State E - Various noxious weeds and invasive nonnative plants makeup a significant portion of the herbaceous vegetation composition; not part of the reference condition, found on contemporary landscapes only.

The montane/subalpine PNVT has a 54 percent or moderate departure rating from desired conditions and reference conditions making it tied with wet mixed conifer forest for the 7th most departed PNVT from desired conditions and 8th most departed PNVT from reference conditions on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference conditions were derived from LANDFIRE (2007c).

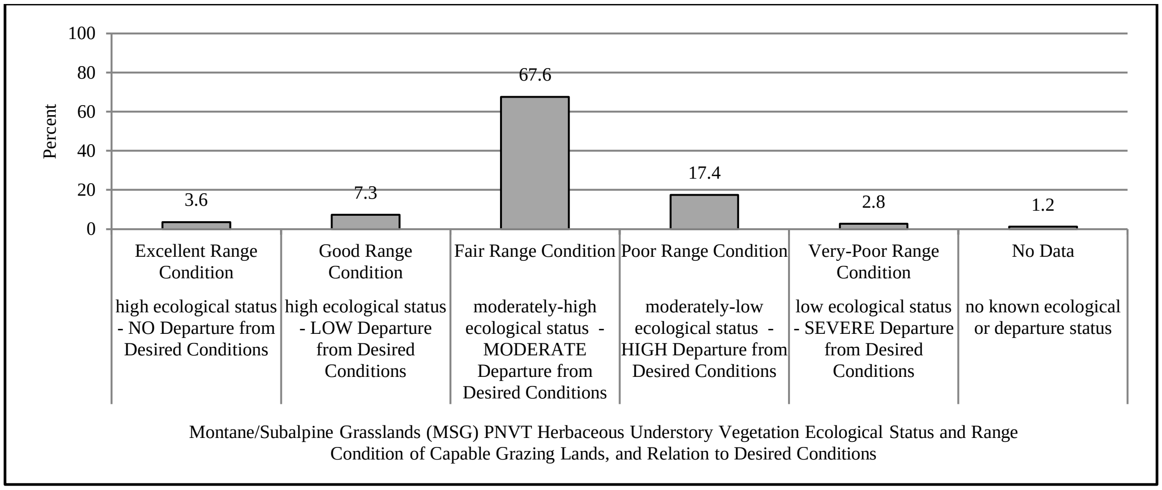

Figure 38. Montane/Subalpine Grasslands Herbaceous Understory Vegetation Condition

The figure above depicts the montane/subalpine Grasslands PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting livestock grazing and departure from desired conditions. Roughly 20 percent of capable grazing lands do not meet desired conditions.

Interior Chaparral

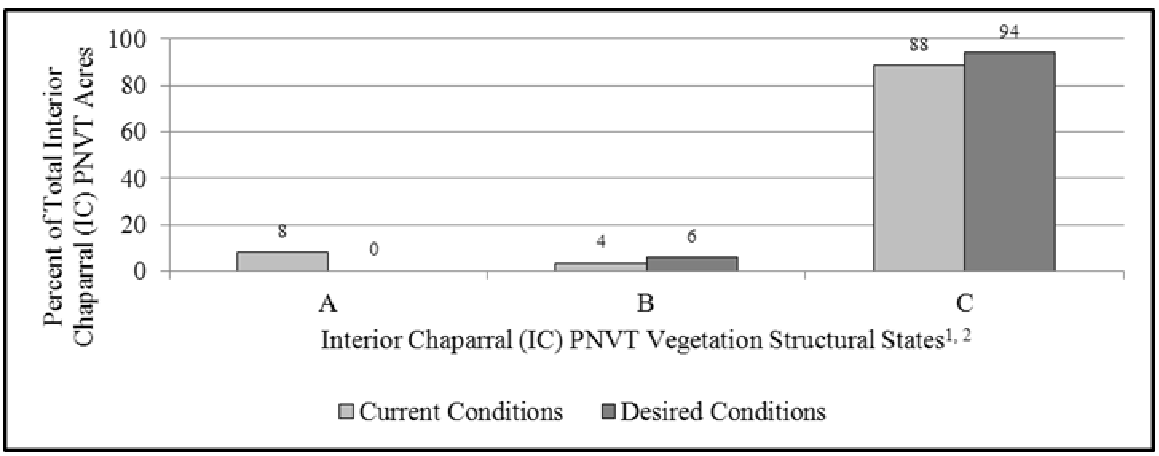

Figure 39. Interior Chaparral Overstory Vegetation Condition

The figure above depicts the interior chaparral PNVT overstory vegetation structural states. At 55,981 acres (approximately 3 percent of the forests), this PNVT ranks 8th in size out of the 14 PNVTs on the Apache-Sitgreaves NFs. The vegetation structural states are

State A - Herbaceous vegetation regeneration, recently burned, sparsely vegetated; with < 10 percent shrub or tree canopy cover; early successional development.

State B - Open perennial herbaceous vegetation, with shrubs, seedling, and sapling size (< 5" diameter) and small size (5–9.9" diameter) trees with open (< 30 percent canopy cover; mid successional development.

State C - Shrubs, seedling, and sapling, small, medium size (10–19.9" diameter), and large to very large size (> 20" diameter) trees with closed (≥ 30) canopy cover, and medium and large to very large size (> 20" diameter) trees with open canopy cover and no herbaceous vegetation understory; late successional development.

The interior chaparral PNVT has an 8 percent or no departure rating from desired conditions and reference conditions making it the least departed PNVT, respectively, on the Apache-Sitgreaves NFs. Desired conditions were provided by the Forest Service Southwestern Regional Office; reference conditions were derived from the Nature Conservancy (Schussman, 2006).

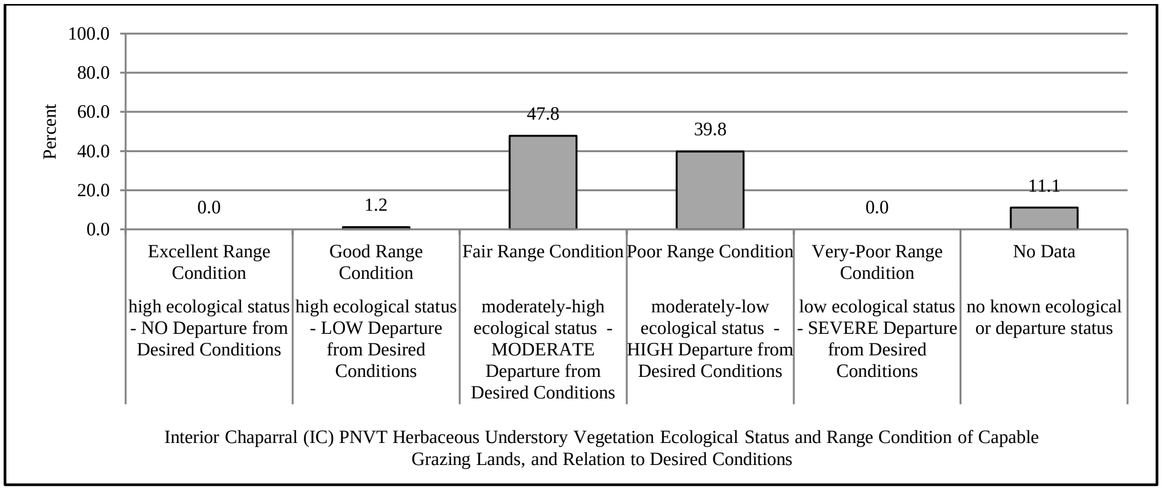

Figure 40. Interior Chaparral Herbaceous Understory Vegetation Condition

The figure above depicts the interior chaparral PNVT's current herbaceous understory vegetation ecological status[2] and range condition[3] of the lands capable[4] of supporting livestock grazing and departure from desired conditions. Roughly 40 percent of capable grazing lands do not meet desired conditions.

Age Classes Typically Occurring on the Apache-Sitgreaves NFs

The figure on the following page provides a graphic representation of ponderosa pine age classes. The four age classes range from 1, the youngest, to 4, the oldest. The four crown vigor classes range from A, the most vigorous, to D, the poorest. Bole diameter is highly dependent upon growing conditions rather than age. In general, class 1 represents trees approximately 4 to 9 inches DBH and 15 to 40 years old, class 2 is approximately 9 to 15 inches DBH and 40 to 75 years, class 3 is 15 to 22 inches DBH and 75 to 130 years, and class 4 is more than 22 inches DBH and more than 130 years old.

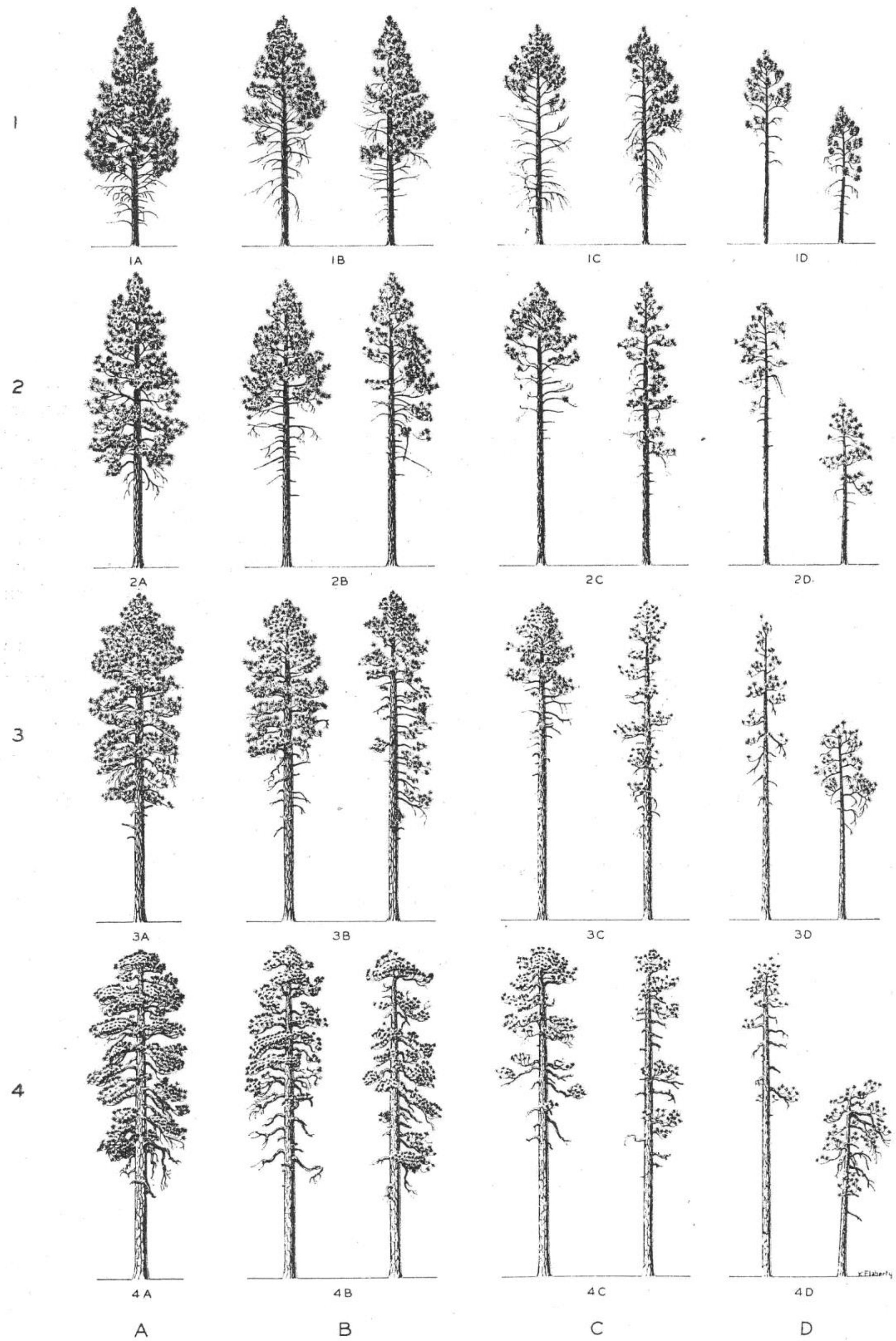

Figure 41. Keen's tree classification for ponderosa pine

Old Growth in the Southwestern Region of the Forest Service

"Old growth" refers to specific habitat components that occur in forests and woodlands: old trees, dead trees (snags), downed wood (coarse woody debris), and structure diversity (Franklin and Spies, 1991; Helms, ed.; 1998; Kaufmann et al., 2007). These important habitat features may occur in small areas, with only a few components, or over larger areas as stands or forests where old growth is concentrated (Kaufmann et al., 2007). In the Southwest, old growth is considered "transitional" (Oliver and Larson, 1996), given that the location of old growth on the landscape shifts over time as a result of succession and disturbance (tree growth and mortality). Some species, notably certain plants, require "old forest" communities that may or may not have old growth components but have escaped significant disturbance for lengths of time necessary to provide the suitable stability and environment.

There is an inverse relationship between the frequency of fire and the contiguity of old growth features (WSDNR, 2005). In frequent fire, all-aged systems (e.g., ponderosa pine, dry mixed conifer, some piñon-juniper types) old growth components can occur individually or in small areas of 0.1 to 1-plus acres (Cooper, 1961; White, 1985), separated spatially from other old growth. In infrequent fire systems (e.g., mixed conifer-aspen, spruce-fir, some piñon-juniper types), old growth components are often concentrated in larger patches, sometimes forming "old growth forest" over tens or hundreds of acres.

Old, and sometimes large, trees are an important component of old growth. It is the decadence (dead tops, dead wood) or structure diversity (flattened crowns, branch characteristics), often associated with old age, that provide essential habitat elements. "Old" is relative to the trees species (Swetnam and Brown, 1992): about 200 years in ponderosa pine (Kaufmann, 1996) and 100 years in aspen. "Large" is also relative to tree species, but it can be roughly divided into two diameter groups: large trees in woodlands and large trees in forests. Large trees in woodlands are approximately 10 inches and greater in diameter (i.e., greater than 25 cm) (Weisz et al., 2012) and consist of piñon, juniper, oak, and other "dwarf" tree species where diameter is measured at the root collar (DRC). Large trees in forests are approximately 20 inches and greater (i.e., greater than 50 cm) and consists of species that dominate montane and subalpine zones, and they are measured at "breast height" (DBH). Large trees are valued for their longevity in providing old growth habitat and for their added ability to enhance structure diversity.

The structure diversity component includes both vertical and horizontal diversity. Vertical diversity is often assessed based on the number of canopy layers. Tree age data is sometimes used as an inference of canopy number (i.e., storiedness) and vice versa. Horizontal diversity can be evaluated using canopy cover and tree stem aggregation statistics, either within or among old growth sites. Structure diversity in old growth is relatively high, but as with the other old growth components, guidelines for structure and age diversity are specific to the PNVT.

Snags are standing dead or partially dead trees that are greater than about 6 feet (2 meters) in height (Helms, ed., 1998). Depending on the species of wildlife, snag diameter for habitat varies upward from 5 inches in diameter (greater than 12 cm) (Ganey, 1999; Harris, 1999; Harrod et al., 1998; Lyon, 1977; McClelland and Frissell, 1975). Management guidelines for the retention and development of snags vary by PNVT and diameter class (Hutto et al., 1993; Thomas et al., 1979). Snags created by fire may not meet habitat needs for some wildlife and are often subject to

separate retention guidelines (Hutto, 2008). Snags created by fire sometimes fall before they become useful as snag habitat.

Coarse woody debris is any woody material on the ground greater than 3 inches (8 cm) at the largest cross section (Brewer, 2008). Like snag guidelines, coarse woody debris guidelines are specific to PNVT and diameter class (Graham et al., 1994).

Vegetation Management Practices

The following table lists various treatment options for use under the uneven-aged and even-aged management systems, as well as intermediate treatments that can be used within either system. See the land management plan glossary for definitions of most silvicultural terms used in the table.

Use of treatment methods listed in the following table requires project level analysis and a NEPA decision document followed by detailed site-specific prescription development and signature by regionally-certified silviculturists. These vegetation management practices are general guidelines. The treatment option chosen for each forest or woodland type and circumstance is determined by a certified silviculturist using guidance in this appendix, a review of applicable technical and scientific literature, and practical experience. Using this knowledge, the silviculturist determines if the practice is relevant to the specific vegetation and site condition. Additional practices may be dictated by other resource goals, particularly in riparian areas.

Forest Service Manual (FSM) 2478.03 (Silvicultural Examinations, Prescriptions, and Evaluations – Policy) requires, in part, that a prescription, detailing the methods, techniques, and timing of silvicultural activities, be prepared prior to initiating any silvicultural treatment on NFS lands.

FSM 5142.1 (Developing Prescribed Fire Burn Plans) requires that a site-specific prescribed fire plan be prepared and approved by a qualified line officer for each prescribed fire in advance of ignition. The prescribed fire plan includes a description of the structure and composition of the vegetation and fuel characteristics and includes resource objective statements that are used to develop the prescribed fire prescription.

Fuels specialists and silviculturists, along with other resource specialists, work together to ensure land management objectives are met. Joint silviculture prescriptions and burn plans may be produced.

Table 14. Standard Vegetation Management Practices for Site-Specific Project Planning and Implementation[a]

DESIRED VEGETATION SPECIES COMPOSITION	Gambel oak, Evergreen oak species, quaking aspen, chaparral species, cottonwood, willow, alder, etc.	***See species below*[b]**	***See species below*[b]**	***See species below*[b]**	***See species below*[b]**	***See species below*[b]**	***See species below*[b]**	***See species below*[b]**	All Forest and Persistent Woodland Types	Grassland, Meadow, and Savanna Woodland Types
STRUCTURE	DESIRED ONE-AGED, SINGLE-STORIED STAND[c]	DESIRED ONE-AGED, SINGLE-STORIED STAND[c]	DESIRED ONE-AGED, SINGLE-STORIED STAND[c]	DESIRED ONE-AGED, SINGLE-STORIED STAND[c]	DESIRED TWO-AGED, TWO-STORIED STAND (Two age classes, each > 10% BA most of the rotation)	DESIRED UNEVEN-AGED, MULTI-STORIED STAND[d]	DESIRED UNEVEN-AGED, MULTI-STORIED STAND[d]	DESIRED UNEVEN-AGED, MULTI-STORIED STAND[d]	ANY DESIRED ONE-, TWO-, or MULTI-STORIED STAND	DESIRED OPEN (Grassland/meadow < 10% woody canopy cover; savanna woodland 10-30% canopy cover)
FUNCTION	Coppice Regeneration Method (vegetation regeneration function)	Clearcutting Regeneration Method (no trees function for seed/shelter)	Seed Tree Regeneration Method (some trees function for seed only)	Shelterwood Regeneration Method (some trees function for seed/shelter)	Irregular Shelterwood Regeneration Method (function for continuous tree cover)	Single-Tree Regeneration Method (function for continuous tree cover)	Group-Selection Regeneration Method (group size = 2-4 acres)	Irregular Group-Shelterwood Regeneration Method	Intermediate Treatment Methods (tree cover kept between stand formation and regeneration= manage existing stand for desired conditions)	No or Few Trees (eliminate tree encroachment; maintain as predominantly herbaceous vegetation)
SILVICULTURAL MANAGEMENT PRACTICES[e] **(options listed are not in any particular order or preference)**	Activity Coppice Coppice w/Reserves Prescribed Fire Protection from heavy ungulate browsing Plant hardwood cuttings in riparian sites Protect regeneration from animal damage	Activity ≤ 5% tree cover post harvest: Patch cut Strip cut Stand cut Prescribed Fire Tree Planting 6-10% tree cover post harvest: Patch cut w/Reserves Strip cut w/Reserves Stand cut w/Reserves Prescribed Fire Tree Planting Protect regeneration from animal damage	Activity Preparatory Seed 1-10% tree cover post harvest: Final Removal Final removal w/Reserves Limited Prescribed Fire Fill-in Tree Planting Protect regeneration from animal damage	Activity Preparatory Seed Group Seed Strip Seed Removal Group Removal Strip Removal Final Removal Final Removal w/Reserves Limited Prescribed Fire Fill-in Tree Planting Protect regeneration from animal damage	Activity Preparatory Seed Removal Final Removal Final Removal w/Reserves -------------------------- Coppice Regeneration Method: Coppice w/Standards (understory must regenerate vegetatively by suckers/sprouts) Over-browsing protection	Activity Single Tree (Individual Tree) Selection Limited Prescribed Fire Activity Group Selection	Group Selection w/Reserves Limited Prescribed Fire Tree Planting Protect regeneration from animal damage	Activity Seed Removal Final Removal Final Removal w/Reserves Limited Prescribed Fire Fill-in Tree Planting Protect regeneration from animal damage	Activity Improvement cuts Free Thinning Low Thinning Liberation Cleaning Weeding Thinning Commercial and Noncommercial Mortality Salvage Sanitation Salvage Prescribed Fire	Activity Grassland Restoration and/or maintenance tree/shrub Cuts Tree Pushing, Chaining Prescribed Fire Careful grazing management for herbaceous vegetation recovery, especially post-fire Intensive animal browsing to maintain herbaceous vegetation cover Herbicide treatments

[a] Standard management practices for certain composition, structure, and function attributes, other than deferral

[b] Ponderosa pine, Rocky Mountain Douglas-fir, blue spruce, Engelmann spruce, southwestern white pine, white fir, subalpine fir, quaking aspen, pine-oak species, Chihuahuan pine, Rocky Mountain juniper, piñon pine, alligator juniper, Utah juniper, one-seed juniper, cottonwood, willow, Arizona cypress, mesquite, etc.

NOTE: Methods and practices listed below will vary by tree species, and those used must be appropriate for the known SILVICS of the desired species.

[c] One-age class composes ≥ 90% of total stand BA for most of the rotation. Age difference between oldest & youngest tree in a class is less than 20% of the rotation.

[d] Three or more distinct age classes

[ec] Daniel et al. (1979). “Principles of Silviculture.” McGraw-Hill, New York. Smith, D.M. (1986). “The Practice of Silviculture.” John C. Wiley & Sons, New York, Helms, J.A., (ed.). (1998). “The Dictionary of Forestry.” The Society of American Foresters.

References

Brewer, D. (2008). Managing Coarse Woody Debris in Fire-adapted Southwestern Forests. Ecological Restoration Institute working paper 21. Northern Arizona University, Flagstaff, AZ. 9 pp.

Cooper, C.F. (1961). Pattern in Ponderosa Pine Forests. *Ecology* 42: 493–499.

Franklin, J.F.; and T.A. Spies. (1991). Ecological definitions of old-growth Douglas-fir forests. Pp. 61–69 in *Wildlife and Vegetation of Unmanaged Douglas-fir Forests*. L.F. Ruggiero, K.B. Aubry, A.B. Carey, and M. Huff, tech. coords. USDA Forest Service Gen. Tech. Rep. PNW-GTR-285. Pacific Northwest Research Station, Portland, OR. 533 pp.

Ganey, J.L. (1999). Snag density and composition of snag populations on two national forests in northern Arizona. *Forest Ecology and Management* 117: 169–178.

Graham, R.T.; A.E. Harvey; M.F. Martin; T.B. Jain; J.R. Tonn; and D.S. Page-Dumroese. (1994). Managing Coarse Woody Debris in Forests of the Rocky Mountains. USDA Forest Service Res. Pap. INT-RP-477. Intermountain Research Station, Ogden, UT. 12 pp.

Harris, R.B. (1999). Abundance and Characteristics of Snags in Western Montana Forests. USDA Forest Service Gen. Tech. Rep. RMRS-GTR-31. Rocky Mountain Research Station, Ft. Collins, CO. 19 pp.

Harrod, R.J.; W.L. Gaines; W.E. Hartl; and A. Camp. (1998). Estimating Historical Snag Density in Dry Forests East of the Cascade Range. USDA Forest Service Gen. Tech. Rep. PNW-GTR-428. Pacific Northwest Research Station, Portland, OR. 16 pp.

Helms, J.A., editor (1998). The Dictionary of Forestry. The Society of American Foresters: Bethesda, MD. 210 pp.

Holechek, J.L.; R.D. Pieper; and C.H. Herbel. (1998). Range management: principles and practices, 3rd ed. Prentice-Hall, Inc. Upper Saddle River, NJ. 542 pp.

Hutto, R.L.; S.J. Hejl; C.R. Preston; and D.M. Finch. (1993). Effects of Silvicultural Treatments on Forest Birds in the Rocky Mountains: Implications And Management Recommendations. Pp. 386-391 in D.M. Finch and P.W. Stangel (eds.), status and management of neotropical migratory birds. USDA Forest Service Gen. Tech. Rep. RM-229. Rocky Mountain Research Station, Ft. Collins, CO.

Hutto, R.L. (2008). The Ecological Importance of Severe Wildfires: Some Like It Hot. *Ecological Applications* 18: 1827–1834.

Kaufmann, M.R. (1996). To live fast or not: growth, vigor, and longevity of old-growth ponderosa and lodgepole pine trees. *Tree Physiology* 16: 139–144.

Kaufmann, M.R.; D. Binkley; P.Z. Fulé; M. Johnson; S.L. Stephens; and T.W. Swetnam. (2007). Defining Old Growth for Fire-Adapted Forests of the Western United States. *Ecology and Society* 12: 15.

LANDFIRE. (2003). Wet grasslands. Draft LANDFIRE Rapid Assessment Model: WGRA. LANDFIRE Project, USDA, Forest Service and USDI, Geologic Survey. 5 pp.

LANDFIRE. (2005). Juniper-pinyon (frequent fire type). Draft LANDFIRE Rapid Assessment Model: JUPI1. LANDFIRE Project, USDA, Forest Service and USDI, Geologic Survey. 8 pp.

LANDFIRE. (2007a). Southern Rocky Mountain dry-mesic montane mixed coniferous forest and woodland. LANDFIRE Biophysical Setting Model, Biophysical Setting: 1510510. LANDFIRE Project, USDA, Forest Service and USDI, Geologic Survey. pp. 42–47.

LANDFIRE. (2007b). Inter-Mountain. Basin semi-desert grassland. LANDFIRE Biophysical Setting Model, Biophysical Setting: 2411350. LANDFIRE Project, USDA, Forest Service and USDI, Geologic Survey. pp. 221–226.

LANDFIRE. (2007c). Southern Rocky Mountain montane subalpine grassland. LANDFIRE Biophysical Setting Model, Biophysical Setting: 1511460. LANDFIRE Project, USDA, Forest Service and USDI, Geologic Survey. pp. 119–224.

LANDFIRE. (2007d). North American warm desert riparian system. LANDFIRE Biophysical Setting Model, Biophysical Setting: 1511551. LANDFIRE Project, USDA, Forest Service and USDI, Geologic Survey. pp. 203–208.

LANDFIRE. (2007e). Montane riparian system. LANDFIRE Biophysical Setting Model, Biophysical Setting: 2411590. LANDFIRE Project, USDA, Forest Service and USDI, Geologic Survey. pp. 203–208.

Lyon, J.L. (1977). Attrition of lodgepole pine snags on the Sleeping Child Burn, Montana. USDA Forest Service Research Note INT-219. Intermountain Forest and Range Experiment Station, Ogden, UT. 4 pp.

McClelland, B.R.; and S.S. Frissell. (1975). Identifying Forest Snags Useful for Hole-Nesting Birds. *Journal of Forestry* 73: 414–417.

Oliver, C.D.; and B.C. Larson. (1996). Forest Stand Dynamics, update addition. New York: John Wiley & Sons. 520 pp.

Schussman, H. (2006). Historical range of variation and state and transition modeling of historical and current landscape conditions for interior chaparral of the Southwestern U.S. Prepared for the USDA Forest Service, Southwestern Region by The Nature Conservancy, Tucson, AZ. 24 pp.

Schussman, H.; and D. Gori. (2006). Historical range of variation and state and transition modeling of historical and current landscape conditions for madrean pine-oak of the Southwestern U.S. Prepared for the USDA Forest Service, Southwestern Region by The Nature Conservancy, Tucson, AZ. 35 pp.

Smith, E. (2006a). Historical range of variation and state and transition modeling of historical and current landscape conditions for ponderosa pine of the Southwestern U.S. Prepared for the USDA Forest Service, Southwestern Region by The Nature Conservancy, Tucson, AZ. 43 pp.

Smith, E. (2006b). Historical range of variation and state and transition modeling of historical and current landscape conditions for mixed conifer of the Southwestern U.S. Prepared for the USDA Forest Service, Southwestern Region by The Nature Conservancy, Tucson, AZ. 31 pp.

Smith, E. (2006c). Historical range of variation and state and transition modeling of historical and current landscape conditions for spruce-fir of the Southwestern U.S. Prepared for the USDA Forest Service, Southwestern Region by The Nature Conservancy, Tucson, AZ. 37 pp.

Swetnam, T.W.; and P.M. Brown. (1992). Oldest Known Conifers in the Southwestern United States: Temporal And Spatial Patterns Of Maximum Age. Pp. 24–38 In Kaufmann, M.R. Moir W.H.; and Bassett, R.L., eds. Old-growth forests in the Southwest and Rocky Mountain regions: The status of our knowledge. USDA Forest Service workshop proceedings, Gen. Tech. Rep. RM-213. Fort Collins, CO. 201 pp.

Thomas, J.W.; R.G. Anderson; C. Master; and E.L. Bull. (1979). Snags. Pp. 60–77 In Thomas, J.W. (tech. ed.), Wildlife Habitats in Managed Forests: The Blue Mountains of Oregon and Washington. USDA Forest Service Agricultural Handbook No. 553. Washington, DC. 512 pp.

Weisz, R.; D. Vandendriesche; and M. Moeur. (February 2012). White Paper O - Overview of How We Created VDDT Models with FVS - Calibrating Natural and Anthropogenic Events in State and Transition Models with FVS: A case study for ponderosa pine forest ecosystems. (One of 16 papers in the regional white paper series titled “The R3 FVS Process for Evaluating the Effects of Vegetation Management Activities in the Forest Plan Revision Process”). USDA Forest Service, Southwestern Region, Regional Office. Albuquerque, NM. Interoffice publication.

White, A.S. (1985). Presettlement Regeneration Patterns in a Southwestern Ponderosa Pine Stand. *Ecology* 66: 589–594.

WSDNR. (2005). Definition and Inventory of Old Growth Forests on DNR-Managed State Lands. Washington State Department of Natural Resources technical report. Olympia, WA. 74 pp.

Appendix C. Communications Sites

The table below displays the designated communications and electronic sites to be administered per Forest Service Manual direction. Most are for Forest Service administration. Future development at all sites should adhere to direction in the "Land Management Plan for the Apache-Sitgreaves National Forests." FSH 2709.11 Chapter 90 provides guidance for communications site management, including definitions of low and high power.

Table 15. Communications sites on the Apache-Sitgreaves National Forests

Site Name	Administrative	Commercial	Low Power (LP) or High Power (HP)
Apache National Forest			
Alpine Heliport	X		LP
Alpine Ranger Station	X		LP
Bear Mountain Lookout	X		LP
Big Lake Lookout and Visitor Center	X		LP
Blue Lookout	X		LP
Escudilla Lookout	X		LP
Nutrioso Communication Site		X	LP
Granville	X		LP
Green's Peak Lookout	X	X	LP
Hannagan Helibase	X		LP
MCI		X	LP
Mitchell Peak	X		LP
P.S. Knoll Lookout	X		LP
Reno Lookout	X		LP
Rose Peak Lookout	X		LP
Sizer Knoll		X	LP
South Mountain	X	X	LP
Springerville Ranger Station	X		LP
Strayhorse	X		LP
Trail Cabin	X		LP
Water Canyon Admin. Site	X		LP
Sitgreaves National Forest			
Brookbank	X	X	LP
Chevelon Butte	X		LP
Chevelon Work Center	X		LP
Deer Springs Lookout	X		LP
Dutch Joe Lookout	X		LP
Gentry Lookout	X		LP
Heber Ranger Station	X		LP

Site Name	Administrative	Commercial	Low Power (LP) or High Power (HP)
Heber Sub-Station	X		LP
Juniper Ridge Lookout	X		LP
Lake Mountain Lookout	X		LP
Lakeside Ranger Station	X		LP
Long Hollow		X	LP
O'Haco Lookout	X		LP
Pinedale Work Center	X		LP
Porter Mountain	X	X	LP, HP[a]
Promontory Lookout	X		LP
Springer Mountain Lookout	X		LP

[a] See the special uses section (guidelines) for additional direction about the high power site at Porter Mountain.

Appendix D. Relevant Laws, Regulations, Policies, and Other Sources of Information

Direction for managing National Forest System land comes from a variety of levels. National and regional direction includes laws, executive orders, regulations, and Forest Service policy. The figure below illustrates this hierarchy of management direction beginning with national and regional direction at the highest level and ending with site-specific, project level direction when the land management plan (the plan) is implemented.

National and Regional Management Direction
Laws, Code of Federal Regulations, Forest Service Policy
⇩
Forestwide Management Direction – Land Management Plan
Desired Conditions, Objectives, Standards, Guidelines
⇩
Management Area Direction – Land Management Plan
Desired Conditions, Objectives, Standards, Guidelines
⇩
Project level Management Direction
Project Decision Documents (Decision Memos, Decision Notices, and Records of Decision)

Figure 42. Hierarchy of management direction for national forests

Management direction includes applicable laws, regulations, and policies, although they generally are not restated in this plan. During plan implementation, a project must be consistent with the direction found in the plan, applicable laws, regulations, and Forest Service Manuals; applicable Forest Service Handbooks provide guidance only and do not provide required direction.

This appendix contains a listing of relevant statutes, regulations, and policies applicable to the Forest Service.

Forest Service Directives

http://www.fs.fed.us/im/directives/

The following is a partial listing of national and regional Forest Service policies relevant to this plan. A complete listing can be found in Forest Service Manuals and Forest Service Handbooks. Together, these are known as the Forest Service Directives System.

The directives system is the primary basis for the management and control of all internal programs and serves as the primary source of administrative direction for Forest Service employees. The system sets forth legal authorities, management objectives, policies, responsibilities, delegations, standards, procedures, and other instructions.

The Forest Service Manual (FSM) contains legal authorities, goals, objectives, policies, responsibilities, instructions, and the necessary guidance to plan and execute assigned programs and activities.

Forest Service Handbooks (FSH) are directives that provide instructions and guidance on how to proceed with a specialized phase of a program or activity. Handbooks either are based on a part of the FSM or they incorporate external directives.

FSM 1000 Organization and Management

- **FSM 1010** Laws, Regulations, and Orders
- **FSM 1020** Forest Service Mission

FSM 1400 Controls

- **FSM 1410** Management Reviews

FSM 1500 External Relations

- **FSM 1560** State, Tribal, County, and Local Agencies, Public and Private Organizations

FSM 1563 American Indian and Alaskan Native Relations **FSM 1600** Information Resources

FSM 1900 Planning

- **FSM 1920** Land and Resource Management Planning
- **FSM 1950** Environmental Policy and Procedures
- **FSM 1970** Economic and Social Evaluation
- **FSH 1909.12** Land and Resource Management Planning Handbook
    - Chapter 82.5 (Interim Management of Eligible or Suitable Rivers)

FSM 2000 National Forest Resource Management

- **FSM 2020** Ecological Restoration and Resilience
- **FSM 2030** Large Scale Event Recovery
- **FSM 2060** Ecosystem Classification, Interpretation, and Application
- **FSM 2070** Vegetation Ecology

FSM 2200 Range Management

- **FSM 2260** Wild Free-Roaming Horses and Burros
- **FSH 2209.13** Grazing Permit Administration Handbook, Southwestern Region supplement

FSM 2300 Recreation, Wilderness, and Related Resource Management

- **FSM 2320** Wilderness Management
- **FSM 2330** Publicly Managed Recreation Opportunities
- **FSM 2350** Trail, River, and Similar Recreation Opportunities
    - FSM 2356 Cave Management
- **FSM 2360** Heritage Program Management

- FSM 2300-99-3 Special Interest Areas, Southwestern Region Supplement
- **FSM 2380** Landscape Management
- **FSH 2309.18** Trails Management Handbook
- **FSH 2309.24** Cultural Resources Handbook
  - Chapter 10 Survey Standards, Southwestern Region Supplement

Chapter 40 Damage Assessment, Southwestern Region Supplement **FSM 2400** Timber Management, Southwestern Region, and Apache-Sitgreaves NFs supplements

- **FSM 2430** Commercial Timber Sales, Southwestern Region and Apache-Sitgreaves NFs supplements, Small Sales and Commercial/Personal Use Permits of Timber, Firewood, and other forest products
- **FSM 2470** Silvicultural Practices
  - FSM 2478.03 Silvicultural Examinations, Prescriptions, and Evaluations – Policy
- **FSH 2409.11 to FSH 2409.26** Timber Management and Silvicultural Practices Handbooks
  - FSH 2409.26b to 2409.26g Reforestation, Timber Stand Improvement, Silvicultural Examination and Prescription, Nursery, Seed, and Tree Handbooks
- **FSH 2409.18** Timber Sale Preparation Handbook
  - Chapter 80 Uses of Timber Other Than Commercial Timber Sales Special Forest Products-Forest Botanical Products
- **FSH 2409.19** Renewable Resources Handbook

Chapter 60 Stewardship Contracting **FSM 2500** Watershed and Air Management

- **FSM 2540** Water Uses and Development, Southwestern Region supplement
- **FSM 2550** Soil Management, Southwestern Region supplement
- **FSH 2509.13** Burned-Area Emergency Response Handbook
  - Chapter 20 Burned-Area Survey and Emergency Treatment Strategy
- **FSH 2509.23** Riparian Area Handbook, Southwestern Region supplement

FSM 2600 Wildlife, Fish, and Sensitive Plant Habitat Management

FSM 2700 Special Uses Management

- **FSH 2709.11** Special Uses Handbook
  - Chapter 40 Special Uses Administration
  - Chapter 50 Standard Forms and Supplemental Clauses, Southwestern Region supplement

FSM 2800 Minerals and Geology

FSM 2900 Invasive Species Management

FSM 3100 Cooperative Fire Protection

FSM 3400 Forest Health Protection

- **FSH 3409.11** Forest Health Protection Handbook

FSM 4000 Research

- **FSM 4063** RNA Management Standards and Resource Protection Guidelines

FSM 5100 Fire Management

- **FSM 5140** Prescribed Fire
  - FSM 5142.1 Developing Prescribed Fire Burn Plans

FSM 5150 Fuel Management **FSM 5400** Land Ownership

- **FSH 5409.13** Land Acquisition Handbook
  - Chapter 30 Land Exchange

FSM 5500 Land Ownership Title Management

FSM 7300 Buildings and Other Structures

- **FSM 7310** Buildings and Related Facilities
- **FSH 7309.11** Buildings and Related Facilities Handbook

FSM 7400 Public Health and Pollution Control Facilities

FSM 7500 Water Storage and Transportation

FSM 7700 Travel Management

- **FSM 7710** Travel Planning
- **FSM 7720** Development (Policy on Transportation)
- **FSM 7730** Operation and Maintenance
- **FSH 7709.55** Travel Analysis
- **FSH 7709.56** Chapter 2 (Road Location) and Chapter 4 (Design)
- **FSH 7709.59** Road Operations and Maintenance Handbook
  - Chapter 41.7 Hazard Identification and Correction

Federal Statutes

The following is a partial listing of relevant laws which have been enacted by Congress. A Federal statute, or law, is an act or bill which has become part of the legal code through passage by Congress and approval by the President (or via congressional override). Although not specified below, many of these laws have been amended.

American Indian Religious Freedom Act (AIRFA) as amended (42 USC 1996)

Protects and preserves for American Indians their inherent right of freedom to believe, express, and exercise the traditional religions of the American Indian, Eskimo, Aleut, and Native

Hawaiians including, but not limited to, access to sites, use, and possession of sacred objects and the freedom to worship through ceremonial and traditional rites.

Americans with Disabilities Act of 1990

Provides a clear and comprehensive national mandate for the elimination of discrimination against individuals with disabilities; for clear, strong, consistent, enforceable standards addressing discrimination against individuals with disabilities; to ensure that the Federal government plays a central role in enforcing the standards established in this act on behalf of individuals with disabilities; and to invoke the sweep of congressional authority, including the power to enforce the 14th amendment and to regulate commerce, in order to address the major areas of discrimination faced by people with disabilities.

Anderson-Mansfield Reforestation and Revegetation Act of October 11, 1949

Provides for the reforestation and revegetation of National Forest System lands and other lands under the administration or control of the Forest Service.

Antiquities Act of 1906 (16 USC 431- 433)

Prevents the appropriation, excavation, injury, or destruction of any historic or prehistoric ruin or monument, or any object of antiquity, situated on lands owned or controlled by the United States without permission. Provides for permits, for misdemeanor-level penalties for unauthorized use, and authorizes the President to declare by public proclamation historic landmarks, historic and prehistoric structures, and other objects of historic or scientific interest that are situated upon lands owned or controlled by the United States to be national monuments, and to reserve as a part thereof parcels of land needed for the proper care and management of the objects to be protected. The Archaeological Resources Protection Act has replaced the Antiquities Act as the authority for special use permits if the resource involved is 100 years old or greater.

Archaeological and Historic Preservation Act of 1974 (AHPA) (16 USC 469)

It is also known as the Archaeological Recovery Act. AHPA amended and expanded the Reservoir Salvage Act of 1960 and was enacted to complement the Historic Sites Act of 1935 by providing for the preservation of significant scientific, historical, and archaeological data which might be lost or destroyed as the result of construction of a federally authorized dam or other construction activity. AHPA also allows for any Federal agency responsible for a construction project to appropriate a portion of project funds for archaeological survey, recovery, analysis, and publication of results.

Archaeological Resources Protection Act of 1979 as amended (ARPA) (16 USC 470 aa et seq.)

The act establishes permit requirements for removal or excavation of archaeological resources from Federal and Indian lands. Provides criminal and civil penalties for the unauthorized excavation, removal, damage, alteration, defacement, or the attempted unauthorized removal, damage, alteration, or defacement of any archaeological resource, more than 100 years of age,

found on Federal or Indian lands. Prohibits the sale, purchase, exchange, transportation, receipt, or offering of any archaeological resource obtained from public lands or Indian lands. The act further directs Federal land managers to survey land under their control for archaeological resources and create public awareness programs concerning archaeological resources.

Architectural Barriers Act of 1968

Ensures that standards for the design, construction, and alteration of buildings owned, leased, or funded by the United States are prescribed to insure, wherever possible, that physically handicapped people have ready access to and use of such buildings.

Bald and Golden Eagle Protection Act of 1940, as amended

Prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. The act defines "take" as "pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest, or disturb." Disturbance includes impacts that result from human-induced alterations in the nesting area even when eagles are not present. Sections 22.26–28 allow take of bald and golden eagles or their nests where it is unavoidable and where it is compatible with the continued preservation of the eagle. Permits for take are issued based on certain criteria such as, but not limited to, certifications, reporting, and monitoring.

Bankhead-Jones Farm Tenant Act of July 22, 1937

Directed the Secretary of Agriculture to develop a program of land conservation and utilization in order to correct maladjustments in land use and, thus, assist in such things as control of soil erosion, reforestation, preservation of natural resources, and protection of fish and wildlife.

Clarke-McNary Act of June 7, 1924

Authorizes and directs the Secretary of Agriculture, in cooperation with land grant colleges and universities or with other suitable state agencies, to aid farmers through advice, education, demonstrations, or other similar means in establishing, renewing, protecting, and managing wood lots, shelterbelts, windbreaks, and other valuable forest growth, and in harvesting, utilizing, and marketing the products thereof. The act also authorizes the secretary to accept, on behalf of the United States, title to any land donated by private landowners to assure future timber supplies or for other national forest purposes.

Clean Air Act of August 7, 1977, as amended (1977 and 1990)

Enacted to protect and enhance the quality of the Nation's air resources; to initiate and accelerate a national research and development program to achieve the prevention and control of air pollution; to provide technical and financial assistance to state and local governments in connection with the development and execution of their air pollution prevention and control programs; and to encourage and assist the development and operation of regional air pollution prevention and control programs.

Clean Water Act (see Federal Water Pollution Control Act)

Common Varieties of Mineral Materials Act of July 31, 1947

Authorizes the Secretaries of the Interior and Agriculture, under such rules and regulations as they may prescribe, to dispose of mineral materials (including but not limited to common varieties of sand, stone, gravel, pumice, pumicite, cinders, and clay) and vegetative materials (including but not limited to yucca, manzanita, mesquite, cactus, and timber or other forest products) on public lands of the United States, if the disposal of such materials is not otherwise expressly authorized by law, is not expressly prohibited by laws of the United States, and would not be detrimental to the public interest.

Cooperative Forestry Assistance Act of July 1, 1978

Authorizes the Secretary of Agriculture to assist in the establishment of a coordinated and cooperative Federal, state, and local forest stewardship program for the management of non-Federal forest lands and forest lands in foreign countries.

Economy Act of June 30, 1932

Authorizes the head of a Federal agency or major organizational unit within an agency to obtain goods or services from a major organizational unit within the same agency or another agency if amounts are available; if it is determined to be in the best interest of the United States government; the agency or unit is able to provide or get by contract the ordered goods or services; and the head of the agency decides ordered goods or services cannot be provided as conveniently or cheaply by a commercial enterprise.

Emergency Flood Prevention (Agricultural Credit Act) Act of August 4, 1978

Authorizes the Secretary of Agriculture to undertake emergency measures for runoff retardation and soil erosion prevention, in cooperation with landowners and users, as the secretary deems necessary to safeguard lives and property from floods, drought, and the products of erosion on any watershed whenever fire, flood, or other natural occurrence is causing or has caused a sudden impairment of that watershed.

Endangered Species Act of 1973, as amended

Authorizes the determination and listing of species as endangered and threatened; prohibits unauthorized taking, possession, sale, and transport of endangered species; authorizes the assessment of civil and criminal penalties for violating the act or regulations; and, authorizes the payment of rewards to anyone furnishing information leading to arrest and conviction for any violation of the act or any regulation issued thereunder. Section 7 of the act requires Federal agencies to use their authorities to carry out programs for the conservation of endangered and threatened species and to insure that any action authorized, funded, or carried out by them is not likely to jeopardize the continued existence of listed species or modify their critical habitat.

Section 4 of the Act directs development and implementation of recovery plans for threatened and endangered species and the designation of critical habitat. Several species listed under the act are

found on the Apache-Sitgreaves NFs, some with recovery plans and some with designated critical habitat. Those with a recovery plan and/or a critical habitat designation as of 2014 are listed below:

- Mexican Wolf, Recovery Plan
- Lesser Long-Nosed Bat, Recovery Plan
- Southwest Willow Flycatcher, Recovery Plan and Critical Habitat
- Mexican Spotted Owl, Recovery Plan and Critical Habitat
- Chiricahua Leopard Frog, Recovery Plan and Critical Habitat
- Little Colorado River Spinedace, Recovery Plan and Critical Habitat
- Apache Trout Recovery Plan
- Spikedace, Recovery Plan and Critical Habitat
- Gila Trout, Recovery Plan
- Loach Minnow, Recovery Plan and Critical Habitat
- Razorback Sucker, Recovery Plan

Energy Policy Act of 2005

Requires the Secretary of Agriculture to ensure timely action on oil and gas permits, improve collection and retrieval of oil and gas information, and improve inspection and enforcement of permit terms (Section 362).

Energy Security Act of June 30, 1980

Authorizes the Secretary of Agriculture to make available timber resources of the National Forest System, in accordance with appropriate timber appraisal and sale procedures, for use by biomass energy projects.

Federal Advisory Committee Act of October 6, 1972

Sets standards and uniform procedures to govern the establishment, operation, administration, and duration of advisory committees.

Federal Cave Resources Protection Act of November 18, 1988

Established requirements for the management and protection of caves and their resources on Federal lands, including allowing land managing agencies to withhold the location of caves from the public, and requiring permits for any removal or collecting activities in caves on Federal lands.

Federal Insecticide, Rodenticide, and Fungicide Act of October 21, 1972

Requires the administrator of the Environmental Protection Agency to prescribe standards for the certification of individuals authorized to use or supervise the use of any pesticide that is classified for restricted use; regulates the sale of restricted use pesticides; and provides penalties for the unauthorized use or sale of restricted use pesticides.

Federal Land Policy and Management Act of October 21, 1976

Requires that public lands be managed in a manner that will protect the quality of scientific, scenic, historical, ecological, environmental, air and atmospheric, water resource, and archaeological values; that, where appropriate, will preserve and protect certain public lands in their natural condition; that will provide food and habitat for fish and wildlife and domestic animals; and that will provide for outdoor recreation and human occupancy and use. Also states that the United States shall receive fair market value of the use of public lands and their resources unless otherwise provided for by law.

Federal Noxious Weed Act, 1974, as amended

Authorizes the Secretary of Agriculture to designate plants as noxious weeds by regulation; to prohibit the movement of all such weeds in interstate or foreign commerce except under permit; to inspect, seize and destroy products, and quarantine areas, if necessary, to prevent the spread of such weeds; and to cooperate with other Federal, state and local agencies, farmers associations, and private individuals in measures to control, eradicate, prevent, or retard the spread of such weeds.

Federal Power Act of June 10, 1920

Provides for cooperation between the Federal Energy Regulatory Commission and other Federal agencies, including resource agencies, in licensing and relicensing power projects.

Federal-State Cooperation for Soil Conservation Act of December 22, 1944

Authorized the adoption of 11 watershed improvement programs in various states for the improvement of water runoff, water flow retardation, and soil erosion prevention.

Federal Water Pollution Control Act and Amendments of 1972 (Clean Water Act)

Enacted to restore and maintain the chemical, physical, and ecological integrity of the Nation's waters. Provides for measures to prevent, reduce, and eliminate water pollution; recognizes, preserves, and protects the responsibilities and rights of states to prevent, reduce, and eliminate pollution, and to plan the development and use (including restoration, preservation, and enhancement) of land and water resources; and provides for Federal support and aid of research relating to the prevention, reduction, and elimination of pollution, and Federal technical services and financial aid to state and interstate agencies and municipalities for the prevention, reduction, and elimination of pollution.

Established goals for the elimination of water pollution; required all municipal and industrial wastewater to be treated before being discharged into waterways; increased Federal assistance for municipal treatment plant construction; strengthened and streamlined enforcement policies; and expanded the Federal role while retaining the responsibility of states for day-to-day implementation of the law.

Federal Water Project Recreation Act of July 9, 1965

Requires that recreation and fish and wildlife enhancement opportunities be considered in the planning and development of Federal water development.

Fish and Wildlife Conservation Act of September 15, 1960

Requires the Secretaries of the Interior and Agriculture, in cooperation with state agencies, to plan, develop, maintain, and coordinate programs for the conservation and rehabilitation of wildlife, fish, and game on public lands under their jurisdiction.

Fish and Wildlife Coordination Act of March 10, 1934

Authorizes the Secretaries of Agriculture and Commerce to provide assistance to and cooperate with other Federal and state agencies to protect, rear, stock, and increase the supply of game and fur-bearing animals, as well as to study the effects of domestic sewage, trade wastes, and other polluting substances on wildlife. The Act also authorizes the preparation of plans to protect wildlife resources, the completion of wildlife surveys on public lands, and the acceptance by Federal agencies of funds or lands for related purposes provided that land donations receive the consent of the state in which they are located.

Food, Conservation and Energy Act of 2008 (2008 Farm Bill) Public Law 110-246 Title VIII – Forestry, Subtitle A, B, and C

Subtitle A: Amendment to the Cooperative Forestry Assistance Act of 1978. Establishes national priorities for private forest conservation, a community forest and open space conservation program, and a secretary level Forest Resources Coordinating Committee.

Subtitle B: Cultural and Heritage Cooperation Authority. Authorizes the Secretary of Agriculture to provide forest products to Indian tribes for traditional and cultural purposes; to protect the confidentiality of certain information, including information that is culturally sensitive to Indian tribes; to utilize National Forest System land for the reburial of human remains and cultural items, including human remains and cultural items repatriated under the Native American Graves Protection and Repatriation Act; prevent the unauthorized disclosure of information regarding human remains or cultural items reburied on National Forest System land; to ensure access to National Forest System land, to the maximum extent practicable, by Indians and Indian tribes for traditional and cultural purposes; to increase the availability of Forest Service programs and resources to Indian tribes in support of the policy of the United States to promote tribal sovereignty and self-determination; and to strengthen support for the policy of the United States of protecting and preserving the traditional, cultural, and ceremonial rites and practices of Indian tribes, in accordance with the American Indian Religious Freedom Act (42 USC 1996).

Subtitle C. Amendments to Other Forestry Related Laws. Amends the Lacey Act to include the illegal taking of plants, establishes an Emergency Forest Restoration Program, and renews authority and funding for the Healthy Forest Reserve Program.

Forest Highways Act of August 27, 1958

Requires that funds available for forest development roads and trails be used by the Secretary of Agriculture to pay for the costs of construction and maintenance thereof, including roads and

trails on experimental and other areas under Forest Service administration, or for adjacent vehicular parking areas and sanitary, water, and fire control facilities. Authorizes the Secretary of Agriculture to enter into contracts with a state or civil subdivision thereof, and issue such regulations, as he deems desirable. See also Highways (23 USC Chapter 205 Forest development roads and trails).

Forest and Rangeland Renewable Resources Planning Act of August 17, 1974

Directs the Secretary of Agriculture to prepare a renewable resource assessment every 10 years; to transmit a recommended renewable resources program to the President every 5 years; to develop, maintain, and, as appropriate, revise land and resource management plans for units of the National Forest System; and to ensure that the development and administration of the resources of the National Forest System are in full accord with the concepts of multiple use and sustained yield.

Freedom of Information Act of November 21, 1974

Governs which government records are released to the public either automatically or upon request.

Geothermal Steam Act of December 24, 1970

Authorizes the Secretary of the Interior to issue leases for the development and utilization of geothermal steam and associated geothermal resources in any lands administered by him or by the Department of Agriculture, and to prescribe such rules and regulations, as he deems appropriate to carry out the provisions of the act.

Granger-Thye Act of April 24, 1950

Authorizes the Forest Service to spend appropriated funds on buildings, lookout towers, and other structures on lands owned by states, counties, municipalities, or other political subdivisions, corporations, or individuals; to procure and operate aerial facilities and services for the protection of national forests; to cooperate with and assist public and private agencies, organizations, institutions, and individuals in performing work on non-forest land for the administration, protection, improvement, reforestation, and other kinds of work as the Forest Service is authorized to do on forest land; to deposit sums from timber purchases to cover the costs of disposing of brush and debris; to permit the use of structures under its control; to sell nursery stock; and other purposes.

Healthy Forests Restoration Act of 2003 (H.R. 1904)

Purposes are to reduce wildfire risk to communities and municipal water supplies through collaborative hazardous fuels reduction projects; to assess and reduce the risk of catastrophic fire or insect or disease infestation; to enhance efforts to protect watersheds and address threats to forest and rangeland health (including wildfire) across the landscape; to protect, restore, and enhance ecosystem components such as biological diversity, threatened/endangered species habitats, and forest productivity.

Historic Sites Act of 1935 (16 USC 461)

Establishes a policy to preserve for public use historic sites, buildings, and objects of national significance for the benefit of the people. Authorizes the National Park Service's National Historic Landmarks Program.

Intergovernmental Cooperation Act of October 16, 1968 (31 USC 6505)

The act permits Federal agencies to provide specialized or technical services to state and local units of government.

Joint Surveys of Watershed Areas Act of September 5, 1962

Authorizes and directs the Secretaries of the Army and Agriculture to make joint investigations and surveys of watershed areas in the United States, Puerto Rico, and Virgin Islands, and to prepare joint reports setting forth their recommendations for improvements needed for flood prevention, for the conservation, development, utilization, and disposal of water, and for flood control.

Knutson-Vandenberg Act of June 9, 1930

Authorizes the Secretary of Agriculture to establish forest tree nurseries; to deposit monies from timber sale purchasers to cover the costs of planting young trees, sowing seed, removing undesirable trees or other growth, and protecting and improving the future productivity of the land; and to furnish seedlings and/or young trees for the replanting of burned-over areas in any national park.

Land Acquisition Act of March 3, 1925

Authorizes the Secretary of Agriculture to purchase land for national forest headquarters, ranger stations, dwellings, or other sites required for the effective performance of the authorized activities of the Forest Service.

Land Acquisition – Title Adjustment Act of July 8, 1943

Authorizes the Secretary of Agriculture to execute and deliver title adjustments if, after the acquisition of the land, the title thereto is legally insufficient for the purposes for which the land was acquired or if the land was acquired through mistake, misunderstanding, error, or inadvertence.

Land and Water Conservation Fund Act of September 3, 1964

Authorizes the appropriation of funds for Federal assistance to states in planning, acquisition, and development of needed land and water areas and facilities and for the Federal acquisition and development of certain lands and other areas for the purposes of preserving, developing, and assuring accessibility to outdoor recreation resources.

Law Enforcement Authority Act of March 3, 1905

Authorizes all Forest Service employees to make arrests for the violation of the laws and regulations relating to the national forests.

Leases Around Reservoirs Act of March 3, 1962

Authorizes the Secretary of Agriculture to amend any lease with respect to lands under the jurisdiction of the Forest Service providing for the construction, maintenance, and operation of commercial recreational facilities at a Federal reservoir project so as to provide for the adjustment of the amount of rental or other consideration payable to the United States under such lease.

Migratory Bird Treaty Act of 1918

Makes it unlawful to “take” migratory birds, their eggs, feathers, or nests. A migratory bird is any species or family of birds that live, reproduce, or migrate within or across international borders at some point during their annual life cycle. Presidential executive order number 13186 additionally directs Federal agencies to integrate bird conservation into agency activities and to design migratory bird habitat and conservation principles and practices into agency environmental planning.

Mineral Leasing Act of February 25, 1920

Provides that the deposits of certain minerals on land owned by the United States shall be subject to lease to citizens of the United States, provided royalties on such deposits are paid to the United States.

Mineral Leasing Act for Acquired Lands Act of August 7, 1947

Extended the provisions of the “mineral leasing laws” to those lands previously acquired by the United States for which they had not been extended, and lands thereafter acquired by the United States.

Mineral Resources on Weeks Law Lands Act of March 4, 1917

Authorizes the Secretary of Agriculture to permit the prospecting, development, and utilization of the mineral resources of the lands acquired under the Weeks Law.

Mineral Springs Leasing Act of February 28, 1899

Authorizes the Secretary of Agriculture to rent or lease to responsible persons suitable spaces and portions of ground near, or adjacent to, mineral, medicinal, or other springs within any national forest where the public is accustomed to or desires to frequent for health or pleasure.

Mining Claims Rights Restoration Act of August 11, 1955

States that all public lands belonging to the United States which have been withdrawn or reserved for power development or power sites shall be open to entry for location and patent of mining claims and mineral development, subject to certain conditions.

Mining and Minerals Policy Act of December 31, 1970

States that it is the policy of the Federal government to foster and encourage the development of economically sound and stable domestic mining, minerals, metal, and mineral reclamation industries; the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security, and environmental needs; mining, mineral, and metallurgical research to promote the wise and efficient use of our natural and reclaimable mineral resources; and the study and development of methods for the disposal, control, and reclamation of mineral waste products and the reclamation of mined land.

Multiple Use–Sustained Yield Act of June 12, 1960

States that it is the policy of Congress that the national forests are established and shall be administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes, and authorizes and directs the Secretary of Agriculture to develop and administer the renewable surface resources of the national forests for the multiple use and sustained yield of products and services.

National Environmental Education Act of November 16, 1970

Enacted to establish and support a program of environmental education for students and personnel working with students in schools, institutions of higher education, and related educational facilities, and to encourage postsecondary students to pursue careers related to the environment.

National Environmental Policy Act of January 1, 1970

Directs all Federal agencies to consider and report the potential environmental impacts of proposed Federal actions, and established the Council on Environmental Quality.

National 1990 Farm Bill (title XII – Forest Stewardship Act) Act of November 28, 1990

Directs the Secretary of Agriculture to establish a competitive forestry, natural resources, and environmental grants program, and provides for other research programs.

National Forest Management Act of October 22, 1976

The National Forest Management Act reorganized, expanded, and otherwise amended the Forest and Rangeland Renewable Resources Planning Act of 1974, which called for the management of renewable resources on National Forest System lands. The National Forest Management Act requires the Secretary of Agriculture to assess forest lands, develop a management program based on multiple use, sustained-yield principles, and implement a resource management plan for each unit of the National Forest System. It is the primary statute governing the administration of national forests.

National Forest Roads and Trails Act of October 13, 1964

Authorizes the Secretary of Agriculture to provide for the acquisition, construction, and maintenance of forest development roads within and near the national forests through the use of appropriated funds, deposits from timber sale purchasers, cooperative financing with other public agencies, or a combination of these methods. The act also authorizes the secretary to grant rights-of-way and easements over National Forest System lands.

National Historic Preservation Act of 1966 as amended (NHPA) (16 USC 470)

Sets forth the Federal government's policy to preserve and protect historical and cultural resources. This act states that the historical and cultural foundations of the Nation should be preserved as a living part of the Nation's community life and development in order to give a sense of orientation to the American people. Directs all Federal agencies to take into account the effects of their undertakings (actions, financial support, and authorizations) on properties included in or eligible for the National Register. Establishes inventory, nomination, protection, and preservation responsibilities for federally owned historic properties. As amended extends the policy in the Historic Sites Act to state and local historical sites as well as those of national significance, expands the National Register of Historic Places, establishes the Advisory Council on Historic Preservation and the State Historic Preservation Officers, and requires agencies to designate Federal preservation officers. Establishes criteria for designating tribal historic preservation officers to assume the functions of a state historic preservation officer on tribal lands.

National Forest System Land and Resource Management Plans (16 U.S.C 1604)

Directs the Secretary of Agriculture to develop, maintain, and, as appropriate, revise land and resource management plans for units of the National Forest System, coordinated with the land and resource management planning processes of State and local governments and other Federal agencies.

National Trails System Act of October 2, 1968

Established a national system of recreation, scenic, and historic trails by designating the initial components of the system and prescribing the methods and standards through which additional components may be added.

Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) (25 USC 3001)

Provides a process for Federal agencies to return Native American human remains, funerary objects, and sacred objects to the ancestors and appropriate Native American tribe. Includes provisions for the intentional excavation and unanticipated discovery of Native American cultural items on Federal and tribal lands, and penalties for noncompliance and illegal trafficking. The act requires agencies to identify holdings of such remains and objects and to work with appropriate Native American groups toward their repatriation.

Occupancy Permits Act of March 4, 1915

Authorizes the Secretary of Agriculture to permit, under such regulations as he may prescribe, the use and occupancy of suitable areas of land within the national forests for the purpose of constructing or maintaining hotels, resorts, or other structures necessary or desirable for recreation, public convenience, or safety; to permit the use and occupancy of suitable land for the purpose of constructing or maintaining summer homes; to permit the use and occupancy of suitable land for the purpose of constructing or maintaining buildings, structures, and facilities for industrial or commercial purposes when such use is consistent with other uses of the national forest; and to permit any state or political subdivision thereof to use or occupy suitable land for the purpose of constructing or maintaining buildings, structures, or facilities necessary or desirable for education or for any other public use or in connection with any other public activity.

Oil and Gas Leasing Reform Act of 1987

Amended the Mineral Lands Leasing Act of 1920 regarding competitive leasing of oil and gas for onshore Federal lands. Sets forth guidelines for the promulgation of regulations regarding lease sales, and prohibits the issuance of oil or gas leases upon certain lands allocated or designated as wilderness areas.

Organic Administration Act of June 4, 1897

Authorizes the President to modify or revoke any instrument creating a national forest; states that no national forest may be established except to improve and protect the forest within its boundaries, for the purpose of securing favorable conditions of water flows, and to furnish a continuous supply of timber for the use and necessities of citizens of the United States. Authorizes the Secretary of Agriculture to promulgate rules and regulations to regulate the use and occupancy of the national forests.

Petrified Wood Act of September 28, 1962

Authorizes the Secretary of Agriculture to promulgate regulations under which limited quantities of petrified wood may be removed from the national forests.

Pipelines Act of February 25, 1920

Authorizes the Secretary of the Interior or appropriate agency head to grant rights-of-way through any Federal lands for pipeline purposes for the transportation of oil, natural gas, synthetic liquid or gaseous fuels, or any refined product produced therefrom to any applicant possessing the qualifications provided in the act.

Public Buildings Cooperative Use Act of 1976

Authorizes the Federal government to acquire and utilize space in suitable buildings of historic, architectural, or cultural significance, unless use of such space would not prove feasible and prudent compared with available alternatives; to encourage the location of commercial, cultural, educational, and recreational facilities and activities within public buildings; to provide and maintain space, facilities, and activities, to the extent practicable, which encourages public access to and stimulates public pedestrian traffic around, into, and through public buildings, permitting cooperative improvements to and uses of the area between the building and the street, so that such

activities complement and supplement commercial, cultural, educational, and recreational resources in the neighborhood of public buildings; and to encourage the public use of public buildings for cultural, educational, and recreational activities.

Public Land Surveys Act of March 3, 1899

Provides that all standard, meander, township, and section lines of public land surveys shall be established under the direction and supervision of the Commissioner of the General Land Office, whether the lands to be surveyed are within or without reservations, except that where the exterior boundaries of public forest reservations are required to be coincident with standard, township, or section lines, such boundaries may, if not previously established in the ordinary course of the public land surveys, be established and marked under the supervision of the director of the United States Geological Survey. This act made the surveying of forest reserve lands identical, in all but the establishment of boundaries, with that of the public domain.

Public Rangelands Improvement Act of October 25, 1978

Establishes and reaffirms the national policy and commitment to inventory and identify current public rangeland conditions and trends; manage, maintain and improve the condition of public rangelands so that they become as productive as feasible for all rangeland values in accordance with management objectives and the land use planning process; charge a fee for public grazing use which is equitable; continue the policy of protecting wild free-roaming horses and burros from capture, branding, harassment, or death, while at the same time facilitating the removal and disposal of excess wild free-roaming horses and burros which pose a threat to themselves and their habitat and to other rangeland values.

Rescission Act of 1995

Directs the Forest Service to establish and adhere to a schedule for analysis and decisions on all grazing allotments where National Environmental Policy Act of 1969 (NEPA) compliance is required. Notwithstanding any other law, term grazing permits which expire or are waived before the NEPA analysis and decision pursuant to the schedule developed by individual Forest Service System units, shall be issued on the same terms and conditions and for the full term of the expired or waived permit. Upon completion of the scheduled NEPA analysis and decision for the allotment, the terms and conditions of existing grazing permits may be modified, if necessary to conform to such NEPA analysis and subsequent decision.

Rehabilitation Act of 1973, as amended

States that it is national policy that the Federal government plays a leadership role in promoting the employment of individuals with disabilities, and in assisting states and providers of services in fulfilling the aspirations of such individuals with disabilities for meaningful and gainful employment and independent living.

Religious Freedom Restoration Act (RIFRA) (42 USC § 2000bb)

Government shall not substantially burden a person’s exercise of religion even if the burden results from a rule of general applicability, except when the government demonstrates that

application of the burden to the person is in furtherance of a compelling governmental interest; and is the least restrictive means of furthering that compelling governmental interest.

Renewable Resources Extension Act of June 30, 1978

Authorizes and directs the Secretary of Agriculture, in cooperation with the state directors of the Cooperative Extension Service programs, to provide educational programs relating to forest and rangeland renewable resources.

Research Grants Act of September 6, 1958

Authorizes the Secretary of the Interior to enter into contracts with educational institutions, public or private agencies or organizations, or persons to conduct scientific or technological research.

Rural Development Act of August 30, 1972

Enacted to provide multistate regional agencies, states, counties, cities, multicounty planning and development districts, businesses, industries, Indian tribes on Federal and state reservations, or other federally recognized Indian tribal groups and others involved with public services and investments in rural areas or that provide or may provide employment in these areas the best available scientific, technical, economic, organizational, environmental, and management information and knowledge useful to them, and to assist and encourage them in the interpretation and application of this information to practical problems and needs in rural development.

Safe Drinking Water Amendments of November 18, 1977

Amended the Safe Drinking Water Act to authorize appropriations for research conducted by the Environmental Protection Agency relating to safe drinking water; Federal grants to states for public water system supervision programs and underground water source protection programs; and grants to assist special studies relating to the provision of a safe supply of drinking water.

Secure Rural Schools and Community Self-Determination Act of 2000

Through this law the Forest Service gives rural communities the means to build and improve schools, provide road maintenance, emergency services, and conservation programs for their citizens. Thus, communities are no longer dependent on Federal timber sales from national forests to improve local schools and roads.

Sikes Act of October 18, 1974, as amended

This act authorizes the Forest Service to cooperate with state wildlife agencies in conservation and rehabilitation programs for fish, wildlife, and plants considered threatened or endangered.

Small Tracts Act of January 22, 1983

Authorizes the Secretary of Agriculture to sell, exchange, or interchange by quitclaim deed all right, title and interest, including the mineral estate, of the United States in and to certain lands within the national forest when he determines it to be in the public interest.

Smokey Bear Act of May 23, 1952

Prohibits the unauthorized use of the “Smokey Bear” character or name.

Soil and Water Resources Conservation Act of November 18, 1977

Provides for a continuing appraisal of the United States’ soil, water and related resources, including fish and wildlife habitats, and a soil and water conservation program to assist landowners and land users in furthering soil and water conservation.

Solid Waste Disposal Act (Resource Conservation and Recovery Act) of October 21, 1976

Promotes the protection of health and the environment and the conservation of valuable material and energy resources by providing technical and financial assistance to state and local governments and interstate agencies for the improvement of solid waste management techniques.

Supplemental National Forest Reforestation Fund Act of September 18, 1972

Directs the Secretary of Agriculture to establish a supplemental national reforestation fund, and states that money transferred to this fund shall be available to the secretary for the purpose of supplementing programs of tree planting and seeding on National Forest System lands determined by the secretary to be in need of reforestation.

Surface Mining Control and Reclamation Act of August 3, 1977

Authorizes the Secretary of Agriculture to enter into agreements with landowners, providing for land stabilization, erosion, and sediment control, and reclamation through conservation treatment, including measures for the conservation and development of soil, water, woodland, wildlife, and recreation resources, and agricultural productivity of such lands.

Sustained Yield Forest Management Act of March 29, 1944

Authorizes the Secretaries of Agriculture and the Interior to establish by formal declaration cooperative sustained-yield units which shall consist of federally owned or administered forest land under their jurisdiction and, in addition thereto, land which reasonably may be expected to be made the subject of one or more of the cooperative agreements with private landowners authorized by section 2 of the act in order to promote the stability of forest industries, employment, communities, and taxable forest wealth through continuous supplies of timber and forest products; and in order to secure the benefits of forests in the maintenance of water supply, regulation of streamflow, prevention of soil erosion, amelioration of climate, and preservation of wildlife.

Timber Export Act of March 4, 1917

Permits the Secretary of Agriculture to allow timber or other forest products to be cut or removed from a national forest and exported from the state or territory in which that national forest is situated.

Timber Exportation Act of April 12, 1926

Authorizes the exportation of lawfully cut timber from the state or territory where grown if the supply of timber for local use will not be endangered, and authorizes the Secretary to issue rules and regulations to carry out the provisions of the act.

Title Adjustment Act of April 28, 1930

Authorizes the Secretaries of the Interior and Agriculture to execute a quitclaim deed where an application for a conveyance of land has been withdrawn or rejected.

Toxic Substances Control Act of October 11, 1976

Grants the administrator of the Environmental Protection Agency the authority to regulate chemical substances and mixtures, which present an unreasonable risk of injury to the public health or the environment, and to take action with respect to chemical substances and mixtures, which are imminent hazards.

Transfer Act of February 1, 1905

Transferred the management and control of the Forest Reserves from the General Land Office (GLO) in the Department of the Interior to the Bureau of Forestry in the Department of Agriculture.

Tribal Forest Protection Act of 2004 (Public Law 108-278)

Authorizes the Secretaries of the Interior and Agriculture to enter into an agreement or contract with Indian tribes meeting certain criteria to carry out projects to protect Indian forest land.

Twenty-Five Percent Fund Act of May 23, 1908

Provides that 25 percent of all monies received from the sale of timber or other forest products shall be paid to the state in which such forest is located to be expended as the state may prescribe for the benefit of public schools and roads.

Uniform Federal Accessibility Standards U.S. Criminal Code (Title 18 USC Chapter 91 – Public Lands) Act of June 25, 1948

Defines the crimes and criminal procedure for crimes committed against public lands.

U.S. Mining Laws (Public Domain Lands) Act of May 10, 1872

Provides that all valuable mineral deposits in lands belonging to the United States, both surveyed and unsurveyed, are free and open to exploration and purchase, and the lands in which they are found to occupation and purchase by citizens of the United States and those who have declared their intention to become such, under regulations prescribed by law, and according to the local customs or rules of miners, so far as the same are applicable and not inconsistent with the laws of the United States. There are a number of acts which modify the mining laws as applied to local areas by prohibiting entry altogether or by limiting or restricting the use which may be made of the surface and the right, title, or interest which may pass through patent.

Volunteers in the National Forests Act of May 18, 1972

Authorizes the Secretary of Agriculture to recruit, train, and accept without regard to the civil service classification laws, rules, or regulations the services of individuals without compensation as volunteers for or in aid of interpretive functions, visitor services, conservation measures and development, or other activities in and related to areas administered by the secretary through the Forest Service.

Water Quality Improvement Act of April 3, 1970

Amends the prohibitions of oil discharges, authorizes the President to determine quantities of oil which would be harmful to the public health or welfare of the United States; to publish a national contingency plan to provide for coordinated action to minimize damage from oil discharges. Requires performance standards for marine sanitation device and authorizes demonstration projects to control acid or other mine pollution, and to control water pollution within the watersheds of the Great Lakes. Requires that applicants for Federal permits for activities involving discharges into navigable waters provide state certification that they will not violate applicable water quality standards.

Water Resources Planning Act of July 22, 1965

Encourages the conservation, development, and utilization of water and related land resources of the United States on a comprehensive and coordinated basis by the Federal government, states, localities, and private enterprises.

Watershed Protection and Flood Prevention Act of August 4, 1954

Establishes policy that the Federal government should cooperate with states and their political subdivisions, soil or water conservation districts, flood prevention or control districts, and other local public agencies for the purposes of preventing erosion, floodwater, and sediment damages in the watersheds of the rivers and streams of the United States; furthering the conservation, development, utilization, and disposal of water, and the conservation and utilization of land; and thereby preserving, protecting, and improving the Nation’s land and water resources and the quality of the environment.

Weeks Act Status for Certain Lands Act of September 2, 1958

Subjects all lands of the United States within the exterior boundaries of national forests which were or hereafter are acquired for or in connection with the national forests or transferred to the Forest Service for administration and protection substantially in accordance with national forest regulations, policies, and procedures, excepting (a) lands reserved from the public domain or acquired pursuant to laws authorizing the exchange of land or timber reserved from or part of the public domain, and (b) lands within the official limits of towns or cities, notwithstanding the provisions of any other act, to the provisions of the Weeks Act of March 1, 1911 (36 Stat. 961), as amended, and to all laws, rules, and regulations applicable to National Forest System lands acquired thereunder.

Wild Free-Roaming Horses and Burros Act of December 15, 1971, as amended by Federal Land Policy Management Act of 1976 and Public Rangelands Improvement Act of 1978

Protects wild free-roaming horses and burros from capture, branding, harassment, or death; and states they are to be considered in the area where presently found an integral part of the natural system of the public lands.

Wild and Scenic Rivers Act of October 2, 1968

Instituted a National Wild and Scenic Rivers System by designating the initial components of that system, and by prescribing the methods by which and standards according to which additional components may be added to the system from time to time.

Wilderness Act of September 3, 1964

Established a National Wilderness Preservation System to be composed of federally owned areas designated by Congress as "wilderness areas" and administered for the use and enjoyment of the American people in such manner as will leave them unimpaired for future use and enjoyment as wilderness. Provides for the protection of these areas, the preservation of their wilderness character, and for the gathering and dissemination of information regarding their use and enjoyment as wilderness. The act states that no Federal lands shall be designated as "wilderness areas" except as provided for in the act or by a subsequent act.

Apache-Sitgreaves NFs wilderness areas are designated under the following authorities:

- **Public Law 91-504** of October 23, 1970, designates Mount Baldy Wilderness
- **Arizona Wilderness Act of 1984** (Public Law 48-406) designates Escudilla and Bear Wallow Wilderness areas

Wildlife Game Refuges Act of August 11, 1916

Authorizes the President of the United States to set aside lands for the protection of game animals, birds, or fish; and prohibits the hunting, catching, trapping, willful disturbance, or killing of any kind of game animal, game or nongame bird, or fish, or the taking of eggs of any such bird on any lands so set aside or in or on the waters thereof.

Wood Residue Utilization Act of December 19, 1980

Enacted to develop, demonstrate, and make available information on feasible methods that have the potential for commercial application to increase and improve utilization in residential, commercial, and industrial or power plant applications of wood residues resulting from timber harvesting and forest protection and management activities occurring on public and private forest lands, and from the manufacture of forest products, including wood pulp.

Woodsy Owl/Smokey Bear Act of June 22, 1974

Prohibits the unauthorized manufacture, reproduction, or use of the character "Woodsy Owl" the name "Woodsy Owl," or the associated slogan "Give a Hoot, Don't Pollute." Also prohibits the

unauthorized manufacture, reproduction, or use of the character "Smokey Bear" or the name "Smokey Bear," or a facsimile or simulation of such character or name.

Youth Conservation Corps Act of August 13, 1970

Establishes a Youth Conservation Corps whom the Secretaries of the Interior or Agriculture may employ without regard to the civil service or classification laws, rules, or regulations for the purpose of developing, preserving, or maintaining the lands and waters of the United States.

Regulations

Below is a partial listing of relevant regulations. Federal executive departments and administrative agencies write regulations to implement laws. Regulations are secondary to law. However, both laws and regulations are enforceable.

33 CFR § 323 Permits for Discharges of Dredged or Fill Material into Waters of the United States

This regulation prescribes those special policies, practices, and procedures to be followed by the Corps of Engineers in connection with the review of applications for permits to authorize the discharge of dredged or fill material into waters of the United States.

36 CFR § 60 National Register of Historic Places

Sets forth the procedural requirements for listing properties on the National Register.

36 CFR § 61 Procedures for Approved State and Local Government Historic Preservation Programs

36 CFR § 63 Determinations of Eligibility for Inclusion in the National Register of Historic Places

Developed to assist agencies in identifying and evaluating the eligibility of properties for inclusion in the National Register, and to explain how to request determinations of eligibility.

36 CFR § 65 National Historic Landmarks Program

Sets forth the criteria for establishing national significance and the procedures used by the Department of the Interior for conducting the National Historic Landmarks Program.

36 CFR § 68 The Secretary of the Interior's Standards for Historic Properties

Sets forth standards for the treatment of historic properties containing standards for preservation, rehabilitation, restoration, and reconstruction. These standards apply to all proposed grant-in-aid development projects assisted through the National Historic Preservation Fund.

36 CFR § 79 Curation of Federally Owned and Administered Archaeological Collections

36 CFR § 212 Forest Development Transportation System

Sets forth the requirements for the development and administration of the forest development transportation system.

36 CFR § 219 Planning

Sets forth a process for developing, adopting, and revising land and resource management plans for the National Forest System.

36 CFR § 221 Timber Management Planning

Sets forth the requirements for management plans for national forest timber resources.

36 CFR § 222 Range Management

Sets forth the requirements for range management on the national forests, and for the administration of wild and free-roaming horses and burros and their environment. See Subpart B (Management of Wild Free-Roaming Horses and Burros).

36 CFR § 223 Sale and Disposal of National Forest System Timber

Sets forth the requirements relating to the sale and disposal of National Forest System timber.

36 CFR § 228 Minerals

Sets forth the rules and procedures through which use of the surface of National Forest System lands, in connection with mining and mineral operations, shall be conducted so as to minimize adverse environmental impacts on National Forest System surface resources.

36 CFR § 241 Fish and Wildlife

Sets forth the rules and procedures relating to the management, conservation, and protection of fish and wildlife resources on National Forest System lands.

36 CFR § 251 Land Uses

Sets forth the rules and procedures relating to the use and occupancy of National Forest System lands.

36 CFR § 254 Landownership Adjustments

Sets forth the rules and procedures relating to exchange and conveyance of National Forest System lands.

36 CFR § 261 Prohibitions

Sets forth the general prohibitions relating to the use and occupancy of National Forest System lands.

- 36 CFR 261.7 Unauthorized Livestock

36 CFR § 291 Occupancy and Use of Developed Sites and Areas of Concentrated Public Use

Provides for fees charged for the occupancy and use of developed sites and areas of concentrated public use.

36 CFR § 292 National Recreation Areas

Sets forth the requirements for the administration of national recreation areas.

36 CFR § 293 Wilderness-Primitive Areas

Sets forth the requirements for the administration of wilderness and primitive areas.

36 CFR § 294 Special Areas

Sets forth the requirements for designation of special recreation areas.

36 CFR § 295 Use of Motor Vehicles Off Forest Development Roads

Sets forth the rules and procedures relating to the administrative designation and location of specific areas and trails of National Forest System lands on which the use of motor vehicles traveling off of national forest development roads is allowed.

36 CFR § 296 Protection of Archaeological Resources: Uniform Regulations

Implements the Archaeological Resources Protection Act by establishing the uniform definitions, standards, and procedures for Federal land managers to follow in providing protection for archaeological resources located on public lands and Indian lands, including definitions of prohibited acts and penalties. The regulations also provide requirements for issuing permits under the authority of the Archaeological Resources Protection Act to any person proposing to excavate and/or remove archaeological resources from public lands or Indian lands.

36 CFR § 297 Wild and Scenic Rivers

Sets forth the rules and procedures relating to Federal assistance in the construction of water resources projects affecting wild and scenic rivers or study rivers on lands administered by the Secretary of Agriculture.

36 CFR § 800 Protection of Historic Properties

Sets forth the provisions for the administration of the National Historic Preservation Act.

40 CFR § 121-135 Water Programs

Sets forth the provisions for the administration of water programs including state certification of activities requiring a Federal license or permit, EPA administered permit programs, state program requirements, procedures for decisionmaking, criteria and standards for the National Pollutant Discharge Elimination System, toxic pollutant effluent standards, water quality planning and management, water quality standards, water quality guidance for the Great Lakes System, secondary treatment regulation, and, prior notice of citizen suits. See Title 40 (Protection of Environment), Chapter 1 (Environmental Protection Agency), subchapter D (Water Programs).

40 CFR § 1500 Council on Environmental Quality

Council on Environmental Quality regulations implementing the National Environmental Policy Act.

43 CFR § 3 Preservation of American Antiquities

Implements the provisions of the Antiquities Act of 1906.

43 CFR § 10 Native American Graves Protection and Repatriation Act Regulations

Implements the provisions of the Native American Graves Protection and Repatriation Act of 1990.

50 CFR § 402 Regulations Governing Interagency Cooperation—Endangered Species Act of 1973, as amended

Interprets and implements the act. Addresses forms of consultation (early, formal, informal, and emergency), conferencing, preparation of biological assessments, designation of lead agency, responsibilities of Federal agency following issuance of a biological opinion, reinitiation of formal consultation, and irreversible or irretrievable commitment of resource.

Executive Orders

Below is a partial listing of relevant executive orders. Executive orders are official documents by which the President provides instructions to executive departments and agencies. An executive order may be used to reassign functions among executive branch agencies. It may adopt guidelines, rules of conduct, or rules of procedure for government employees or units of government. It can also establish an advisory body or task force.

E.O. 11593 Protection and Enhancement of the Cultural Environment, 1973

States that the Federal government shall provide leadership in preserving, restoring, and maintaining the historic and cultural environment of the Nation, and that Federal agencies shall administer the cultural properties under their control in a spirit of stewardship and trusteeship for future generations; initiate measures necessary to direct their policies, plans, and programs in such a way that federally-owned sites, structures, and objects of historical, architectural, or archaeological significance are preserved, restored, and maintained for the inspiration and benefit

of the people; and, in consultation with the Advisory Council on Historic Preservation, institute procedures to assure that Federal plans and programs contribute to the preservation and enhancement of non-federally owned sites, structures, and objects of historical, architectural, or archaeological significance.

E.O. 11644 (amended by E.O. 11989) Use of Off-Road Vehicles, 1972, 1977

Establishes policies and provides for procedures that ensure that the use of off-road vehicles on public lands will be controlled and directed so as to protect the resources of those lands, to promote the safety of all users of those lands, and to minimize conflicts among the various uses of those lands.

E.O. 11988 Floodplain Management, 1977

Requires each Federal agency to provide leadership and to take action to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains in carrying out its responsibilities for acquiring, managing, and disposing of Federal lands and facilities; providing federally undertaken, financed, or assisted construction and improvements; and conducting Federal activities and programs affecting land use including, but not limited to, water and related land resources planning, regulating, and licensing activities.

E.O. 11990 Protection of Wetlands, 1977

Requires each Federal agency to provide leadership and to take action to minimize the destruction, loss, or degradation of wetlands, and to preserve and enhance the natural and beneficial values of wetlands in carrying out the agency's responsibilities for acquiring, managing, and disposing of Federal lands and facilities; providing federally undertaken, financed, or assisted construction and improvements; and conducting Federal activities and programs affecting land use including, but not limited to, water and related land resources planning, regulating, and licensing activities.

E.O. 12088 Federal Compliance with Pollution Control Standards (Amended by E.O. 12580), 1978, 1987

Delegates responsibility to the head of each executive agency for ensuring that all necessary actions are taken for the prevention, control, and abatement of environmental pollution. This order gives the Environmental Protection Agency authority to conduct reviews and inspections to monitor Federal facility compliance with pollution control standards.

E.O. 12372 Intergovernmental Review of Federal Programs, 1982

Issued to foster an intergovernmental partnership and a strengthened federalism by relying on state and local government coordination and review of proposed Federal financial assistance and direct Federal development. It requires Federal agencies to provide opportunities for consultation by elected officials of those state and local governments that would provide the non-Federal funds for, or that would be directly affected by, proposed Federal financial assistance or direct Federal development. It also allows states to develop their own process or refine existing processes for

state and local elected officials to use in reviewing and coordinating proposed Federal financial assistance and direct Federal development.

E.O. 12862 Setting Customer Service Standards, 1993

Requires all executive departments and agencies that provide significant services directly to the public to provide those services in a manner that seeks to meet the customer service standard established in the order, and requires agencies to identify customers, survey customers and front-line employees to determine the kind and quality of services needed and barriers to those services, benchmark customer service performance against the best in the business, make information, services, and complaint systems easily accessible, and provide a means to address customer complaints.

E.O. 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, 1994

Addresses environmental justice in minority and low-income populations and is designed to focus Federal attention on the environmental and human health conditions in minority communities and low-income communities with the goal of achieving environmental justice. The order is also intended to promote nondiscrimination in Federal programs substantially affecting human health and the environment, and to provide minority communities and low-income communities' access to public information on, and an opportunity for public participation in, matters relating to human health or the environment.

E.O. 13007 Indian Sacred Sites, 1996

Requires each executive branch agency with statutory or administrative responsibility for the management of Federal lands, to the extent practicable, permitted by law, and not clearly inconsistent with essential agency functions, to accommodate access to and ceremonial use of Indian sacred sites by Indian religious practitioners and to avoid adversely affecting the physical integrity of such sacred sites. Where appropriate, agencies shall maintain the confidentiality of sacred sites.

E.O. 13112 Invasive Species, 1999

Ensures that Federal programs and activities to control and prevent invasive species are coordinated, effective, and efficient. It defines invasive species as "…an alien (or nonnative) whose introduction does or is likely to cause economic or environmental harm or harm to human health."

E.O. 13175 Consultation and Coordination with Indian Tribal Governments, 2000

Promotes regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications, strengthens the United States government-to-government relationships with Indian tribes, and reduces the imposition of unfunded mandates upon Indian tribes.

E.O. 13186 Responsibilities of Federal Agencies to Protect Migratory Birds, 2001

Recognizes the great ecological and economic value of migratory birds to this and other countries and the critical importance of their conservation. Directs agencies to integrate bird conservation principles, measures, and practices into agency activities; avoid or minimize adverse impacts on migratory bird resources when conducting agency actions; restore and enhance the habitat of migratory birds; and ensure that agency plans and actions promote programs and recommendations of comprehensive planning efforts such as Partners-in-Flight.

E.O. 13195 Trails for America in the 21st Century, 2001

Requires Federal agencies, to the extent permitted by law and where practicable and in cooperation with Tribes, States, local governments, and interested citizen groups, protect, connect, promote, and assist trails of all types throughout the United States.

E.O. 13287 Preserve America, 2003

Advances the protection, enhancement, and contemporary use of the historic properties owned by the Federal government, and promotes intergovernmental cooperation and partnerships for the preservation and use of historic properties. Directs Federal agencies to increase their knowledge of historic resources in their care and to enhance the management of these assets. Encourages agencies to seek partnerships with state, tribal, and local governments and the private sector to make more efficient and informed use of their resources for economic development and other recognized public benefits. Better combines historic preservation and nature tourism by directing agencies to assist in the development of local and regional nature tourism programs using the historic resources that are a significant feature of many state and local economies.

E.O. 13352 Facilitation of Cooperative Conservation, 2004

Ensures that the Departments of the Interior, Agriculture, Commerce, and Defense and the Environmental Protection Agency implement laws relating to the environment and natural resources in a manner that promotes cooperative conservation, with an emphasis on appropriate inclusion of local participation in Federal decisionmaking, in accordance with their respective agency missions, policies, and regulations.

E.O. 13433 Facilitation of Hunting Heritage and Wildlife Conservation, 2007

Directs Federal agencies with programs and activities that have a measureable effect on public management, outdoor recreation, and wildlife management, to facilitate the expansion and enhancement of hunting opportunities and the management of game species and their habitat.

State Regulations

Arizona Revised Statute, Title 3 – Agriculture, Chapter 11 (Ownership, Control and Regulation of Livestock), Article 6, Section 3-1371 (Seizure of livestock by a livestock officer).

Arizona Revised Statute, Title 13 – Criminal Code, Chapter 29 (Offenses Against Public Order), Section 13-2927 (Unlawful feeding of wildlife, with exceptions).

Arizona Revised Statute, Title 17 – Game and Fish, Chapter 3 (Taking and Handling of Wildlife), Article 1, Section 17-308 (Unlawful camping).

Arizona Administrative Code, Title 18 – Environmental Quality, Chapter 2 (Department of Environmental Quality Air Pollution Control), Article 15 (Forest and Range Management Burns).

Arizona Administrative Code, Title 18 – Environmental Quality, Chapter 11 (Arizona Water Quality Standards).

Other Sources of Information

Overall Ecosystem Health

- Forest Service, Watershed Condition Framework: A Framework for Assessing and Tracking Changes to Watershed Conditions (FS-977)
- Forest Service, Watershed Condition Classification and Technical Guide (FS-978)

Soil

- FSM 2550 Soil Management, Southwestern Region Supplement, Soil Management
- Forest Service, National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1 (FS-990a)
- Interagency Ecological Site Descriptions: Handbook for Rangelands (January 2013)
- USDA Forest Service, (2013). Technical Guidance for Soil Quality Monitoring in the Southwestern Region, (Letter dated January 16, 2013)

Water Resources

- Arizona Administrative Code, Title 18 – Environmental Quality, Chapter 11 (Arizona Water Quality Standards)
- Memorandum of Understanding between Forest Service Southwestern Region and the State of Arizona Department of Environmental Quality
- Forest Service, Technical Guide to Managing Groundwater Resources Part 2 (Section: Overview of National Groundwater Policy) (FS-881)
- Forest Service, National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1 (FS-990a)
- Forest Service, Groundwater-Dependent Ecosystems: Level II Inventory Field Guide (General Technical Report WO-86b)

Aquatic Habitat and Species

- Species recovery plans (see appendix D)
- Federal Register legal notices for 50 CFR § 217 Endangered Species Act listings, proposed listings, designated critical habitat, proposed critical habitat, 5-year reviews, and other species or habitat status changes Aquatic species current biological opinions
- Arizona Statewide Conservation Agreement for Roundtail Chub, Headwater Chub, Flannelmouth Sucker, Little Colorado River Sucker, Bluehead Sucker, And Zuni Bluehead Sucker

All PNVTs

- FSM 2020 Ecological Restoration and Resilience
- FSM 2470 Silvicultural Practices
- FSM 2478.03 Silvicultural Examinations, Prescriptions, and Evaluations – Policy
- FSM 5142.1 Developing Prescribed Fire Burn Plans
- FSH 2409.17 and FSH 2409.26 Silvicultural Practices Handbook
- FSH 2409.26b to FSM 2409.26g Reforestation, Timber Stand Improvement, Silvicultural Examination and Prescription, Nursery, Seed, and Tree Handbooks
- FSH 3409.11 Forest Health Protection Handbook
- Interagency Prescribed Fire Planning and Implementation Procedures Guide (Section: Prescribed Fire Planning Process)
- Interagency Standards for Fire and Aviation Operations (Red Book), Forest Service Wildland Fire and Aviation Program Organization and Responsibilities (Section: Fuels Management)
- Interagency Ecological Site Descriptions: Handbook for Rangelands (January 2013)

Riparian Areas

- FSH 2509.23 Riparian Area Handbook, Southwestern Region (Section: Standards for Riparian Dependent Resources)
- Forest Service, Technical Guide to Managing Groundwater Resources Part 2 (Section: Overview of National Groundwater Policy) (FS-881)
- Forest Service, National Best Management Practices for Water Quality Management on National Forest System Lands, Volume 1 (FS-990a)
- Forest Service, Groundwater-Dependent Ecosystems: Level II Inventory Field Guide (General Technical Report WO-86b)
- Memorandum of Understanding between Forest Service Southwestern Region and the State of Arizona Department of Environmental Quality
- Bureau of Land Management, Riparian area management: A user guide to assessing proper functioning condition and the supporting science for lotic areas. Tech. Ref. 1737-15
- Bureau of Land Management, Riparian area management: A user guide to assessing proper functioning condition and the supporting science for lentic areas. Tech. Ref. 1737-16.

Wildlife and Rare Plants

- Species recovery plans (see appendix D)
- Federal Register legal notices for 50 CFR § 217 Endangered Species Act listings, proposed listings, designated critical habitat, proposed critical habitat, five-year reviews, and other species or habitat status changes
- Protection of Bald and Golden Eagles-Definition of “Disturb” (Federal Register, Volume 72, Number 107, June 5, 2007); Authorizations Under the Bald and Golden Eagle Protection Act for Take of Eagles (Federal Register, Volume 73, Number 98, May 20,

2008); and Forest Service Southwestern Region direction regarding Permitting Regulations for Take of Eagles (November 18, 2009)

- National and State bald eagle management guidelines (recommendations for avoiding disturbance, activity specific guidelines, and additional recommendations)
- Forest Service, Management Recommendations for the Northern Goshawk in the Southwestern United States (General Technical Report RM-217)
- Terrestrial species current biological opinions
- Conservation assessments/strategies and agreements with the Fish and Wildlife Service and other agencies
- Arizona Game and Fish Department, Nongame and Endangered Wildlife Program, Interagency Management Plan for Gunnison's Prairie Dogs in Arizona (Section: Conservation Objectives and Actions)
- Arizona Game and Fish Department, Arizona State Wildlife Action Plan (SWAP) (Sections: Species of Greatest Conservation Need, Stressors to Wildlife, Conservation Actions, Monitoring)
- Arizona Game and Fish Department, Wildlife 20/20 Strategic Plan (Section: Habitat Conservation)
- Fish and Wildlife Service, Division of Migratory Birds, Bird Conservation Regions 16 and 34, Birds of Conservation Concern
- Arizona Game and Fish Department, Nongame and Endangered Wildlife Program, Arizona Partners in Flight Conservation Plan (Technical Report 142, Chapter V)
- Forest Service and the Western Hummingbird Monitoring Network, Western Hummingbird Partnership Action Plan (Section V: Conservation Actions)
- Memorandum of Understanding between the Forest Service and the Fish and Wildlife Service to Promote the Conservation of Migratory Birds
- Memorandum of Understanding between Animal and Plant Health Inspection Service – Wildlife Services and the Forest Service National Forest System (concerning wildlife damage management on National Forest System lands)
- Memorandum of Understanding among the Arizona Game and Fish Department, New Mexico Game and Fish Department, Animal and Plant Health Inspection Service Wildlife Services, Forest Service, Fish and Wildlife Service, White Mountain Apache Tribe, and various counties in Arizona and New Mexico for the conservation, management, and wild persistence of the Mexican wolf in its recovery area
- Conservation Assessment and Strategy for the Bald Eagle in Arizona with multi-partner interagency Memorandum of Understanding (Nest Watch Program, Post-Delisting Nest Area Monitoring, Winter Roost and Counts, Strategies Regarding Maintenance of Existing and Establishment of New Breeding Closures, Recreation, and Development)
- Western Association of Fish and Wildlife Agencies, Wild Sheep Working Group, Recommendations for Domestic Sheep and Goat Management in Wild Sheep Habitat (Management Recommendations)

Invasive Species

- FSM 2900 Invasive Species Management
- FSM 3400 Forest Health Protection and Southwestern Region Supplement 3400-91-1
- FSH 3409.11 Forest Health Protection Handbook

- Forest Service, Environmental Assessment for the Apache-Sitgreaves National Forests Integrated Forestwide Noxious or Invasive Weed Management Program and Management Plan
- Forest Service, Guide to Noxious Weed Prevention Practices
- Forest Service, Operational Guidelines for Aquatic Invasive Species Prevention and Equipment Cleaning
- Annual Interagency Guidance for Preventing Spread of Aquatic Invasive Organisms Common to the Southwestern Region (Section: Technical Guidelines for Fire Operations) State of Arizona, Aquatic Invasive Species Management Plan
- Field guide to noxious and invasive weeds known to occur or are potentially occurring on the Apache-Sitgreaves National Forests. USDA Forest Service, Southwestern Region, MR-R3-01-2.

Landscape Scale Disturbance Events

- FSM 2020 Ecological Restoration and Resilience
- FSM 2030 Large Scale Event Recovery
- FSM 2070 Vegetation Ecology
- FSH 2509.13 Burned-Area Emergency Response Handbook, Chapter 20 – Burned-Area Survey and Emergency Treatment Strategy
- FSH 7709.59 Road Operations and Maintenance Handbook, Chapter 41 – Highway Safety Program Components (Section: Hazard Identification and Correction)
- FSH 2409.17 Silvicultural Practices Handbook, Chapter 2 – Reforestation and Southwestern Region Supplement

Overall Recreation Opportunities

- Forest Service, Outdoor Recreation Accessibility Guidelines (FSORAG) (Section: Technical Provisions).
- Forest Service, Trails Accessibility Guidelines (FSTAG) (Section: Technical Provisions)
- Forest Service, Apache-Sitgreaves National Forests Recreation Facility Analysis.

Motorized Opportunities

- FSM 2350 Trail, River, and Similar Recreation Opportunities
- FSH 2309.18 Trails Management Handbook FSM 7700 Travel Management
- FSH 7709.56 Road Preconstruction Handbook, Chapter 2 – Road Location and Chapter 4 – Design
- 36 CFR § 212, 251, 261, 295 Travel Management, Designated Routes and Areas for Motor Vehicle Use; Final Rule
- Forest Service, Apache-Sitgreaves National Forests Best Management Practices for Road Maintenance

Nonmotorized Opportunities

- FSM 2350 Trail, River, and Similar Recreation Opportunities
- FSH 2309.18 Trails Management Handbook

Eligible and Suitable Wild and Scenic Rivers

- FSH 1909.12 Land Management Planning Handbook, Chapter 80 – Wild and Scenic River Evaluation (Section: Interim Management of Eligible or Suitable Rivers)
- Forest Service, Eligibility Report for the National Wild and Scenic River System Apache-Sitgreaves National Forests

Scenic Resources

- FSM 2380 Landscape Management
- Forest Service, Landscape Aesthetics: A Handbook for Scenery Management (Agriculture Handbook 701)

Lands

- FSH 2709.11 Special Uses Handbook
- FSH 5409.13 Land Acquisition Handbook, Chapter 30 – Land Exchange
- FSH 7709.59 Road System Operations and Maintenance Handbook, Chapter 41 – Highway Safety Program Components (Section: Hazard Identification and Correction)

Cultural Resources

- FSM 2360 Heritage Program Management
- FSM 2360.1-2361.32d Special Interest Areas a_90-4
- FSM 2360 Special Interest Areas, Southwestern Region Supplement 2300-99-3
- FSH 2309.24 Cultural Resources Handbook, Southwestern Region Supplement, Chapter 10 – Survey Standards
- FSH 2309.24 Cultural Resources Handbook, Southwestern Region Supplement, Chapter 40 – Damage Assessment
- Forest Service, Southwestern Region, Cultural Affiliations: Prehistoric Cultural Affiliations of Southwestern Indian Tribes
- National Register Bulletin 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties
- Secretary of Interior National Register Bulletins
- Secretary of Interior Guidelines for Rehabilitation of Historic Buildings
- Archeology and Historic Preservation: Secretary of the Interior Standards and Guidelines, as amended and annotated
- Advisory Council on Historic Preservation, Consultation with Indian Tribes in the Section 106 Review Process: A Handbook
- Advisory Council on Historic Preservation, Guidance of Coordinating NEPA and Section 106
- Arizona State Historic Preservation Office's Context Studies, Standards, and Guidelines
- Arizona State Historic Preservation Office Historic Archaeology: A Research Guide
- First Amended Programmatic Agreement Regarding Historic Property Protection and Responsibilities among New Mexico Historic Preservation Officer and Arizona State Historic Preservation Officer and Texas State Historic Preservation Officer and Oklahoma State Historic Preservation Officer and the Advisory Council on the Historic

Preservation and United States Department of Agriculture Forest Service Southwestern Region

American Indian Rights and Interests

- FSM 1563 American Indian and Alaskan Native Relations
- FSH 1509.13 American Indian and Alaska Native Relations Handbook, Chapter 10 – Consultation with Tribes; Chapter 30 – Voluntary Closures
- FSH 2409.19 Renewable Resources Handbook, Chapter 60 – Stewardship Contracting, Amendment Number 2409.19-2008-7
- FSH 2409.18 Timber Sale Preparation Handbook, Chapter 80 –Uses of Timber Other Than Commercial Timber Sales Special Forest Products-Forest Botanical Products
- USC Title 25 Indians, Chapter 32 – A Cultural and Heritage Cooperation Authority, (Section: 3051-3057)
- 36 CFR § 261 Prohibitions in Areas Designated by Order; Closure of National Forest System Lands To Protect Privacy of Tribal Activities
- National Register Bulletin 38, Guidelines for Evaluating and Documenting Traditional Cultural Properties
- U.S. Department of Agriculture, Departmental Regulation Number 1350-002: Tribal Consultation, Coordination, and Collaboration
- U.S. Department of Agriculture, Report to the Secretary of Agriculture: USDA Policy and Procedures Review and Recommendations Indian Sacred Sites
- Memorandum of Understanding Regarding Interagency Coordination for Protection of Indian Sacred Sites
- Memorandum of Understanding Among the U.S. Department of Defense, U.S. Department of the Interior, U.S. Department of Agriculture, U.S. Department of Energy, and the Advisory Council on Historic Preservation Regarding Interagency Coordination and Collaboration for the Protection of Indian Sacred Sites
- Forest Service, Southwestern Region, Values, Attitudes and Beliefs Toward National Forest System Lands: Arizona Tribal Peoples (1996)
- U.S. Department of Agriculture, American Indians and Alaska Native: A Guide to USDA Programs
- Advisory Council on Historic Preservation, Consultation with Indian Tribes in the Section 106 Review Process: A Handbook

Forest Products

- FSM 2400 Timber Management
- FSH 2409.11 to FSH 2409.26 Timber Management Handbooks
- FSH 2409.18 Timber Sale Preparation Handbook, Chapter 80 – Uses of Timber Other Than Commercial Timber Sales Special Forest Products-Forest Botanical Products (Sections: Free Use, Administrative Use, Sales of Special Forest Products and Forest Botanical Products)

Livestock Grazing

- FSH 2209.13 Grazing Permit Administration Handbook, Southwestern Region Supplement
- Forest Service, Southwestern Region, Rangeland Analysis and Management Training Guide (2013)
- Bureau of Land Management, Measuring and Monitoring Plant Populations (Technical Reference 1730-1, 1998)
- Arizona Grazing Lands Association, Guide to Rangeland Monitoring and Assessment, (2012)

Minerals and Geology

- FSM 2356 Cave Management
- Memorandum of Understanding between the National Speleological Society and the Forest Service Cave and Karst Management
- 36 CFR § 228, Subpart A – Locatable Minerals
- 36 CFR Part 290 Cave Resources Management
- Central Arizona Grotto. 2015. Recommendations for Apache-Sitgreaves National Forest Cave and Karst Management http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fseprd511748.pdf

Special Uses

- FSH 2709.11 Special Uses Handbook, Chapter 40 – Special Uses Administration
- FSH 2709.11 Special Uses Handbook, Chapter 50 – Standard Forms and Supplemental Clauses (Section: Policy)FSH 2709.11 Special Uses Handbook, Southwestern Region Supplement, Chapter 50 – Terms and Conditions

Water Uses

- Forest Service, Technical Guide to Managing Groundwater Resources Part 2 (Section: Overview of National Groundwater Policy) (FS-881)
- Forest Service, Groundwater-Dependent Ecosystems: Level II Inventory Field Guide (General Technical Report WO-86b)

Wildland Fire Management

- FSM 5142.1 Developing Prescribed Fire Burn Plans
- Forest Service, Southwestern Region, Minimum Impact Suppression Tactics
- Interagency Prescribed Fire Planning and Implementation Procedures Guide (Section: Prescribed Fire Planning Process)
- Interagency Standards for Fire and Aviation Operations (Red Book), Forest Service Wildland Fire and Aviation Program Organization and Responsibilities
- Interagency Guidance for Implementation of Federal Wildland Fire Management Policy (February 13, 2009)
- Annual Interagency Guidance for Preventing Spread of Aquatic Invasive Organisms Common to the Southwestern Region (Section: Technical Guidelines for Fire Operations)

- National Wildfire Coordinating Group Memorandum Number 024-2010, Terminology Updates Resulting from Release of the Guidance for Implementation of Federal Wildland Fire Management Policy (2009)
- Forest Service, Apache-Sitgreaves National Forests Fire Management Plan
- Apache, Navajo, and Greenlee Counties Community Wildfire Protection Plans

Energy Corridors

- Record of Decision: USDA Forest Service Designation of Section 368 Energy Corridors on National Forest System Land in 10 Western States, January 14, 2009: Appendix A: FS Land Use Plan Amendments
- Memorandum of Understanding among the U.S. Department of Agriculture, U.S. Department of Commerce, U.S. Department of Defense, U.S. Department of Energy, Environmental Protection Agency, The Council on Environmental Quality, The Federal Energy Regulatory Commission, The Advisory Council on Historic Preservation, and U.S. Department of the Interior, regarding cooperation in Federal agency review of electric transmission facilities on Federal land

Wilderness

- FSM 2320 Wilderness Management
- FSM 5150 Fuel Management
- Forest Service, Southwestern Region, Minimum Impact Suppression Tactics
- Forest Service, Minimum Requirements Decision Guide http://www.wilderness.net/MRA
- Forest Service, Apache-Sitgreaves National Forests Fire Management Plan
- Wilderness.net toolboxes http://wilderness.net/index.cfm?fuse=toolboxes
- Forest Service, Keeping it Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System (RMRS-GTR-212)

Primitive Areas

- Forest Service, Southwestern Region, Minimum Impact Suppression Tactics.
- Forest Service, Minimum Requirements Decision Guide http://www.wilderness.net/MRA
- Forest Service, Apache-Sitgreaves National Forests Fire Management Plan
- Wilderness.net toolboxes http://wilderness.net/index.cfm?fuse=toolboxes

Recommended Wilderness

- Forest Service, Southwestern Region, Minimum Impact Suppression Tactics
- Forest Service, Minimum Requirements Decision Guide http://www.wilderness.net/MRA
- Forest Service, Keeping it Wild: An Interagency Strategy to Monitor Trends in Wilderness Character Across the National Wilderness Preservation System (RMRS-GTR-212)

Appendix E. Proposed and Possible Management Actions

Introduction

This appendix describes some of the proposed and possible management actions that may take place on the Apache-Sitgreaves NFs at the project or activity level during the planning period (approximately 10 to 15 years) to maintain or move toward desired conditions as described in this plan. This list is not intended to be all inclusive; it is simply a list of possible actions that may take place based on the plan objectives and management approaches. This information is not a commitment to take any action and is not a "proposal" as defined by the Council on Environmental Quality regulations for implementing NEPA (40 CFR § 1508.23, 42 USC 4322(2)C)).

A plan amendment is not required to change or modify any of the proposed or possible management actions. The list of these actions can be updated at any time through an administrative change of the plan.

Proposed Management Actions

The objectives in chapter 2 of the plan represent projects or activities intended to be accomplished during the planning period. These are listed in the table below.

Table 16. List of proposed management actions (plan objectives)

Category	Project/Activity	Timeframe to Complete
Overall Ecosystem Health	Improve the condition class on at least 10 priority 6th level HUC watersheds by removing or mitigating degrading factors.	Planning Period
Soil	Enhance or restore an average of 350 acres per year within priority 6th level HUC watersheds, including treating the causes of State and federally designated impaired or threatened waters to improve watershed condition and water quality.	Annually
Aquatic Habitat and Species	Enhance or restore 5 to 15 miles of stream and riparian habitat to restore structure, composition, and function of physical habitat for native fisheries and riparian-dependent species.	Annually
Aquatic Habitat and Species	Complete at least five projects (e.g., remove barriers, restore dewatered stream segments, or connect fragmented habitat) to provide for aquatic and riparian-associated species and migratory species.	Planning Period
Riparian Areas	Move 200 to 500 acres toward desired composition, structure, and function of streams, floodplains, and riparian vegetation.	Annually
Riparian Areas	Relocate, repair, improve, or decommission a minimum of 4 miles of National Forest System roads or trails that add sediment to streams, damage riparian vegetation, erode streambanks, cause gullies, and/or compact floodplain soils.	Planning Period
Riparian Areas	Remove an average of 2 miles of unauthorized roads or trails that add sediment to streams, damage riparian vegetation, erode streambanks, cause gullies, and/or compact floodplain soils.	Annually

Category	Project/Activity	Timeframe to Complete
Riparian Areas	Enhance or restore 5 to 25 wet meadows or cienegas to proper hydrologic function and native plant and animal species composition.	Planning Period
Riparian Areas	Work with partners to reduce animal damage to native willows and other riparian species on an average of 5 miles of riparian habitat.	Annually
Forests	Treat 5,000 to 35,000 acres to reduce tree densities, restore natural fire regimes, promote species habitat and ecosystem health, reduce fire hazard, maintain desired conditions, initiate recovery from uncharacteristic disturbance, and provide forest products, leaving a desired mix of species with the range of desired densities that are resilient to changing climatic conditions.	Annually
Aspen	Aspen dominated and codominated acres within forested PNVTs, representing a range of age classes, are maintained on at least 50,000 acres.	Planning Period
Woodlands	Treat or maintain 5,000 to 15,000 acres to promote a highly diverse structure.	Annually
Grasslands	Decrease or maintain the woody canopy cover at less than 10 percent by treating up to 25,000 acres.	Annually
Wildlife and Rare Plants	Improve wildlife connectivity by removing at least five unneeded structures (e.g., fence).	Annually
Invasive Species	Contain, control, or eradicate invasive species (e.g., musk thistle, Dalmatian toadflax) on 500 to 3,500 acres.	Annually
Invasive Species	Control or eradicate invasive species (e.g., tamarisk, bullfrogs) on at least 2 stream miles.	Annually
Dispersed Recreation	Rehabilitate, stabilize, revegetate, or relocate an average of five dispersed campsites to improve recreation opportunities and/or protect the environment.	Annually
Dispersed Recreation	Work with Arizona Game and Fish Department, Arizona Department of Transportation, and other partners to provide at least 10 new wildlife viewing opportunities.	Planning Period
Developed Recreation	Reduce the developed recreation deferred maintenance backlog at plan approval by 10 percent.	Planning Period
Developed Recreation	Accessible and wildlife-proof trash facilities should be provided in all developed sites where trash is collected.	Planning Period
Motorized Opportunities	Maintain at least 20 percent of the passenger vehicle and 10 percent of the high-clearance vehicle NFS roads.	Annually
Motorized Opportunities	Maintain at least 20 percent of NFS motorized trails.	Annually
Nonmotorized Opportunities	Maintain at least 20 percent of nonmotorized trails.	Annually
National Recreation Trails	Initiate the process for the regional forester to remove the NRT designation from the Escudilla Trail in conformance with Forest Service Manual 2353.57 – Management of National Recreation Trails.	Within 5 years of plan approval
Scenic Resources	Accomplish an average of five projects to enhance scenic resources (e.g., restore grasslands and aspen, remove unnecessary fences, close and rehabilitate unneeded gravel/cinder pits).	Annually

Category	Project/Activity	Timeframe to Complete
Lands	Survey and post on average 2 to 5 miles of unposted NFS boundary.	Annually
Lands	Maintain on average 2 to 5 miles of property boundary posting and corner monuments.	Annually
Lands	Resolve an average of three existing trespass cases.	Annually
Cultural Resources	National Register sites and priority cultural resources are inspected.	Every 2 years or according to Southwestern Region Heritage program standards
Cultural Resources	Nominate at least five eligible cultural resources for inclusion in the National Register of Historic Places (NRHP).	Planning Period
Cultural Resources	Provide a Passport in Time (PIT) or other education project to provide opportunities for the public to learn about the Apache-Sitgreaves NFs' past and cultural resources.	Annually
Cultural Resources	Complete a minimum of 100 acres of nonproject cultural inventory to expand existing knowledge about the nature, location, and management needs of the forests' cultural resources.	Annually
American Indian Rights and Interests	A minimum of five MOUs are renewed or established with tribes associated with the Apache-Sitgreaves NFs.	Planning Period
Forest Products	Prepare and offer up to an average of 122,000 CCF from suitable timberlands resulting from sustainable harvest to provide wood products to businesses and individuals.	Annually
Forest Products	Provide up to 94,000 CCF (119,380 cords) of firewood for personal and commercial use.	Annually
Forest Products	Provide an average of 5,000 permits for Christmas trees.	Annually
Water Uses	Prepare at least one instream flow water rights applications until water acquisition needs are complete to sustain riparian areas, fish, wildlife, and water-based recreation.	Annually

Possible Management Actions

The "Management Approaches" sections of chapters 2 and 3 of the plan describe some of the possible management actions for achieving desired conditions and objectives. These are summarized below.

Overall Ecosystem Health

- Use the Watershed Condition Framework process to identify priority watersheds for restoration.
- Restore watersheds through treatments to reestablish and then maintain natural fire regimes, improve riparian condition, restore meadows or openings, repair gullies, and reduce erosion.
- Utilize wildland fire (prescribed fire and use of wildland fire) to reintroduce fire into the ecosystems, restore natural fire regimes, and remove excessive fuels.

Air

- Work with the State of Arizona in the air quality regulatory process.

Soil

- Restore areas by seeding, mulching, stabilization of gullies, and obliteration of unauthorized routes.
- Update the Terrestrial Ecosystem Survey (TES) to reflect current conditions and concepts.

Water Resources

- Establish streamside management zones to protect water quality.

Aquatic Habitat and Species

- Prioritize habitat improvement projects with an emphasis on federally listed species and other species with population or habitat concerns.
- Cooperate with the Arizona Game and Fish Department to protect and reintroduce native aquatic species and control or eradicate nonnative species.
- Enhance or restore aquatic habitat through stabilization of stream banks and road crossings, facilitation of aquatic species passage and movement, restoration of perennial flows and native vegetation, and removal of unneeded impoundments.

Vegetation Management

- Prioritize vegetation treatments in focus watersheds and areas identified in community wildfire protection plans, including regular treatments to maintain desired conditions in the Community-Forest Intermix Management Area.
- Collect, store, propagate, and use local plant materials for continued genetic diversity.
- Use appropriate cutting methods, regeneration, and/or fire to accomplish vegetation treatment objectives and to manage dwarf mistletoe and other insect and disease infestations. Possible vegetation management practices are identified in “Appendix B. Vegetation Management Practices.”
- Work with the Arizona Game and Fish Department to address concerns about long term aspen reestablishment. Restore aspen by providing/improving substitute forage away from aspen, removing conifer competition, fencing to exclude ungulates, and range management practices.

Riparian Areas

- Prioritize treatments in riparian areas to occur in focus watersheds and those that have native fish and aquatic species concerns.
- Use the Proper Functioning Condition (PFC) methodology to inventory riparian condition.
- Improve riparian conditions by removing non-riparian species, planting or restoring native species, stabilizing or eliminating roads, encouraging beaver colonization, and constructing fencing. Treatments may include restoration of hardwood and cottonwood galleries, restoration of upland conditions by removing encroaching trees and/or reducing tree densities, and restoration of infrequent fire.

- Alter or remove large human constructed dams to restore and/or improve riparian and wetland functionality.
- Work with the Arizona Game and Fish Department to minimize ungulate impacts to riparian vegetation and structure.
- Work with the U.S. Fish and Wildlife Service to update existing conservation agreements and develop new ones as needed.

Wildlife and Rare Plants

- Work collaboratively with the Arizona Game and Fish Department to protect and reintroduce native species and to control or eradicate nonnative, undesirable species.
- Cooperate with other State and Federal agencies, tribes, as well as private entities and adjacent landowners, to support species diversity, recovery, and wildlife management.
- Implement actions (e.g., closures, timing of treatments, seasonal road restrictions) to prevent relisting of species as threatened or endangered or provide wildlife refuge.
- Coordinate with the Arizona Game and Fish Department, Arizona Wildlife Linkages Working Group, and Arizona Department of Transportation to enhance public safety and promote passage of wildlife. Develop, construct, and install habitat connecting and safer wildlife crossings, and modify proposals to account for critical wildlife linkages.
- Coordinate with USDA Wildlife Services program and the State of Arizona to promote healthy populations of predators, while reducing livestock conflicts with wildlife.
- Promote public education and valuing of the wildlife resource on the forests.

Invasive Species

- Use an array of tools (chemical, biological, mechanical, and cultural) to control or eradicate invasive species.
- Provide education and outreach programs designed to increase awareness of invasive species.
- Implement preventative measures (e.g., pre- and post-work equipment sanitation, requiring certified weed-free seed and hay) through permitting, contracting, and other forest administrative processes.
- Collaborate with other agencies and entities to replace nonnative aquatic species with natives.
- Encourage the Arizona Department of Transportation to treat noxious weeds and nonnative invasive plants along highways.
- Cooperate with the Natural Resource Conservation Service, Arizona Game and Fish Department, Arizona Department of Transportation, local governments, and other organizations to support a successful invasive species management program.

Landscape Scale Disturbance Events

- Remove hazard trees and salvage dead trees, or consider deferring restoration or salvage projects, where extensive tree mortality exists.
- Plant trees and shrubs when needed to establish native vegetation and/or habitat recovery.
- Evaluate developed sites and roads for continued and future use. Decommission or relocate roads that are no longer necessary or safe.
- Re-establish forest boundary and/or other ownership landlines and land survey monuments.

Developed and Dispersed Recreation

- Complete supply and demand studies to better understand recreation needs.
- Use private ventures and partnerships to help provide recreation opportunities.
- Develop management plans, including vegetation management strategies, for dispersed and developed recreation areas.
- Operate and maintain recreation and administrative developments.
- Redesign facilities to accommodate persons with disabilities, respond to demographic changes, and reduce conflicts. Balance new construction with current and future maintenance requirements.
- Develop additional recreation rentals (e.g., cabins).

Motorized and Nonmotorized Opportunities

- Enhance opportunities for motorized trail users, relocate trails to reduce conflicts, and develop management plans for designated motorized use areas.
- Implement the Travel Management Rule (36 CFR § 212).
- Construct temporary roads where needed for emergency operations or contract, permit, lease, or other written authorization.
- Remove routes from the transportation system with follow-up treatments including outsloping roadbeds, removal of stream crossing structures, breaching of drainage ditches, removal of unstable fills, maintenance or restoration of fish passage, and removal of invasive weeds.
- Implement measures (e.g., education, signage, law enforcement, seasonal road closures) to discourage encroachment of motorized vehicles into nonmotorized areas.
- Coordinate with the Federal Highway Administration and Arizona Department of Transportation to facilitate transportation needs, planned improvements, and transportation conditions.
- Work with the Arizona Department of Transportation to alleviate concerns with scenic resources, maintenance activities, use of herbicides, use of deicing agents, and creation of safety turnouts, parking lots, and wildlife crossings.
- Use educational techniques (e.g., brochures, signs) to help users understand motorized and nonmotorized use etiquette.
- Maintain trails to provide for user safety, minimize erosion, provide recreation opportunities, and accommodate administrative needs. Work with partners, user groups, and volunteers to maintain trails.
- Reconstruct or add nonmotorized trails near population centers or developed recreation sites.

Scenic Byways

- Implement projects and activities outlined in the “Coronado Trail Corridor Management Plan.”

Eligible and Suitable Wild and Scenic Rivers

- Conduct suitability studies for eligible wild and scenic rivers.

Conservation Education

- Provide public information, interpretive services, and environmental education programs and activities that connect people to the land and to each other.
- Operate and maintain two visitor centers.

Lands

- Complete land adjustments (e.g., exchanges, purchases) to consolidate the NFS land base, reduce administrative problems and costs, enhance public access and use, and support resource management objectives.
- Work with local communities to understand their community expansion needs. Work with communities during development of their master plans and with communities, developers, and homeowner groups to retain legal access to public lands.
- Use education, partnerships, and law enforcement to reduce trespass issues.

Cultural Resources

- Inventory, protect, study/evaluate, interpret, and preserve cultural resources.
- Collaborate with other forests, the State Historic Preservation Officer, the public, and affiliated tribes to develop management strategies for cultural resources.

American Indian Rights and Interests

- Develop and maintain effective working relationships and recognize American Indian tribal viewpoints.
- Repatriate human remains and artifacts.
- Implement temporary closures of forest lands for traditional and cultural purposes.

Forest Products

- Use timber production and tree cutting to achieve vegetation desired conditions, contribute to the local and regional economy, and achieve such purposes as restoration, salvage, fuels management, insect and disease mitigation, hazard tree removal, protection or enhancement of wildlife habitat, perform research or administrative studies, or recreation and scenery management.
- Offer up to the allowable sale quantity (ASQ) an average of 122,000 CCF per year. The ASQ represents the amount of timber (not including firewood or nonindustrial wood) that may be sold from lands suitable for timber production. Offer other desired forest products, such as house logs, through permits or small sales.
- Use a variety of partnerships and authorities for making forest products available to uses (e.g., Tribal Forest Protection Act, procurement contracts, stewardship contracts, forest products permits).
- Identify specific areas for forest product removal (e.g., Christmas tree, firewood).

Livestock Grazing

- Complete environmental analysis and assess and update allotment management plans to emphasize sustainable stocking levels, forage utilization, mitigation measures, and appropriate grazing systems.

- Adjust timing, intensity, and frequency of livestock grazing to respond to changing resource conditions, including drought.
- Evaluate and determine appropriate use for vacant allotments.
- Work with permittees, the State, tribes, and other organizations to maintain or improve rangeland conditions.
- Work with the Tonto National Forest, Arizona Game and Fish Department, sheep permittees, and other permittees to administer the Heber-Reno and Morgan Mountain sheep driveways.
- Work with non-permittee livestock owners to prevent unauthorized livestock.
- Maintain range developments (e.g., fence, corrals).

Minerals and Geology

- Cooperate with the State and other agencies to inventory, mitigate, and rehabilitate hazardous abandoned mines and mined areas.
- Develop pit plans for mineral material pits.
- Develop cave management plans as needed.

Special Uses

- Issue special use authorizations that complement other opportunities and are based on public need or cannot be met on private or other Federal lands.
- Process requests for energy development and transmission corridors.
- Work with public road agencies to accept USDA easements on roads they maintain and/or provide access to private properties.

Water Uses

- Provide adequate water supplies to support the mission of the Agency and maintain continuous water supplies to downstream uses on and off the forests.
- Participate in water rights adjudications and honor the water rights of others.
- Work with State and other agencies to deal with groundwater issues and maintain instream flows.
- Conserve water through education of water uses on conservation measures and by applying good water management practices.

Wildland Fire Management

- Use a decision support process to guide and document wildfire management decisions that provide for firefighter and public safety, minimize costs and resource damage, and are consistent with values to be protected and management objectives.
- Develop site-specific burn plans to guide implementation of the plan’s prescribed fire treatment objectives.
- Consider developing joint silvicultural prescriptions and burn plans.
- Coordinate management of wildland fire with neighboring jurisdictions.

Management Areas

- Use mechanized methods and prescribed fire on a regular basis in the Community-Forest Intermix Management Area. Work with adjacent landowners and communities to encourage new and existing developments to take into account measures to protect people, property, and natural resources from wildfire.
- Improve wildlife habitat and maintain existing wildlife developments within the Wildlife Quiet Area Management Area.
- Conduct ecological restoration activities including restoration of ecological conditions or habitat components, soil stabilization, prescribed fire and use of wildland fire, hazardous fuels reduction, and invasive species reduction with the Natural Landscape Management Area.
- Recommend land in the Recommended Research Natural Area and Recommended Wilderness Management Areas for special area designation.
- Develop wilderness management plans.

Appendix F. Maps

This appendix contains maps of management areas. More information on management areas can be found in chapter 3. These maps were generated using the most current data available in the Apache-Sitgreaves NFs' Geographic Information System (GIS). As the GIS database is updated, these maps may need to be updated.

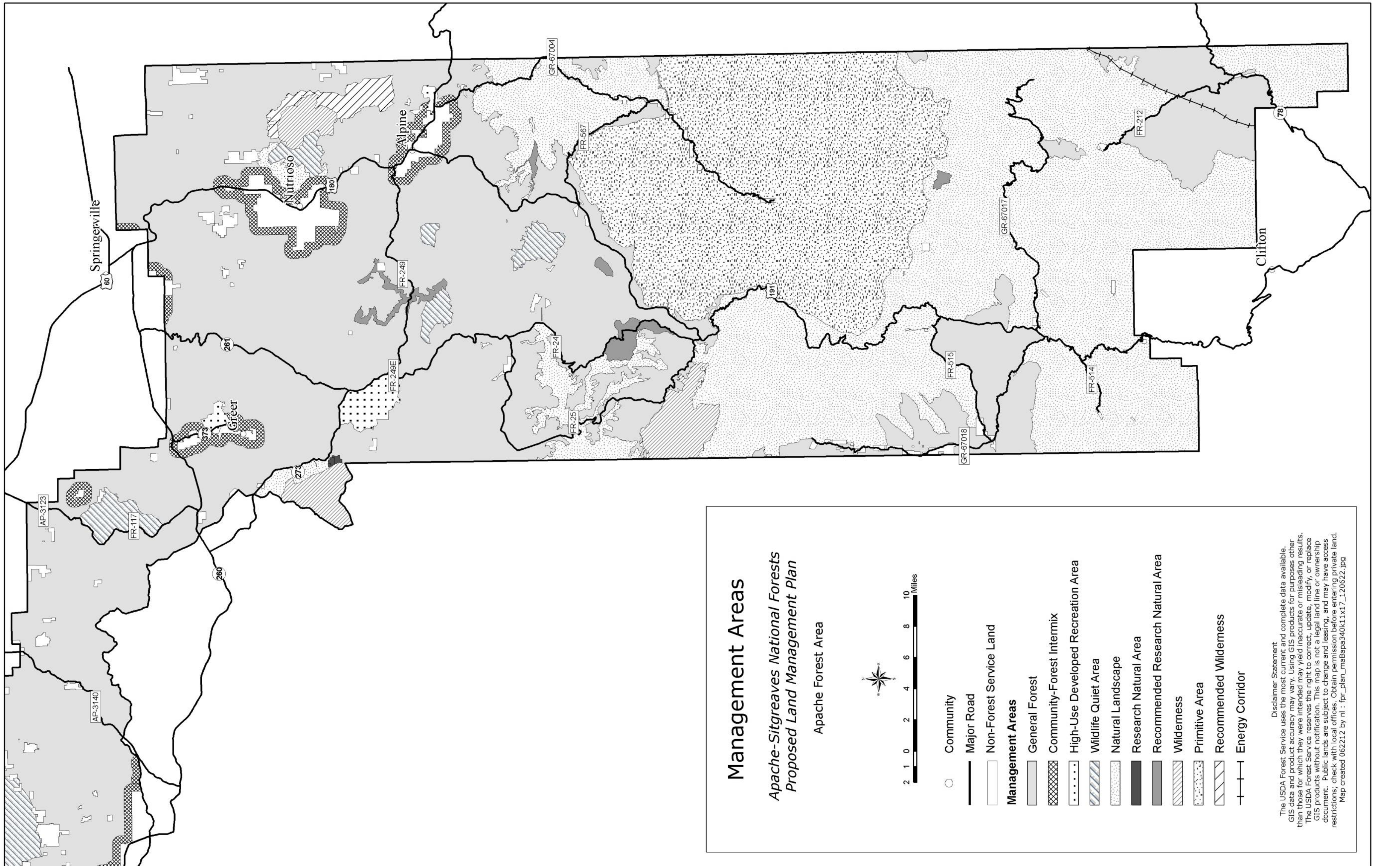

Figure 43. Management Areas on the Apache-Sitgreaves NFs (Apache National Forest area)

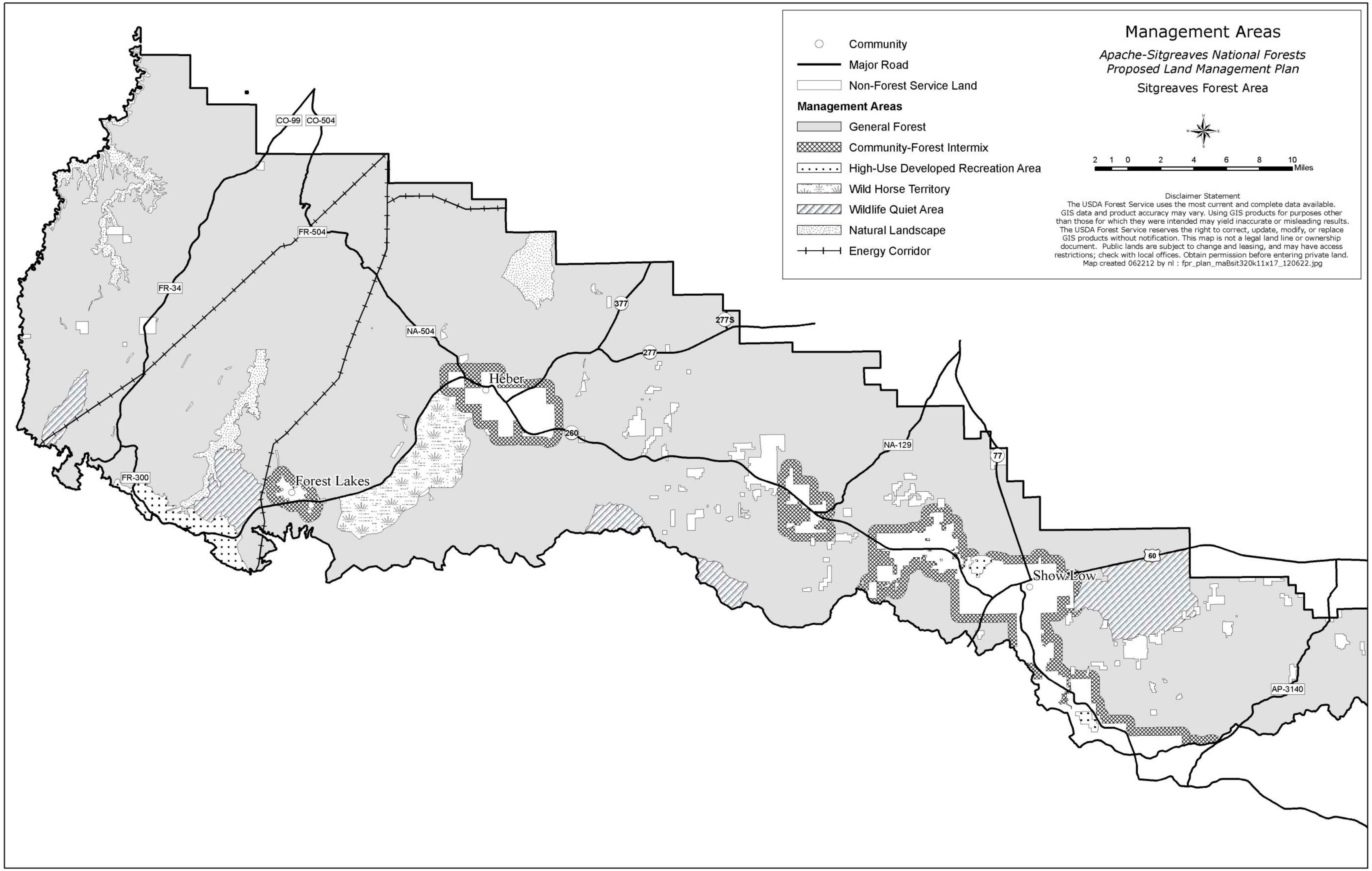

Figure 44. Management Areas on the Apache-Sitgreaves NFs (Sitgreaves National Forest area)

Index

air resources, 18–20
air quality, 18, 114, 142, 149
airshed, 142, 150
American Indian, 12, 89–92, 92–94, 100, 135, 139
aquatic habitat, 18, 22–24, 25–27, 76, 143
aquatic management zones, 24
Arizona State agencies
Arizona Department of Agriculture, 118
Arizona Department of Environmental Quality (ADEQ), 19, 142, 161
Arizona Department of Transportation (ADOT), 64, 67, 72, 77, 99, 103
Arizona Department of Water Resources (ADWR), 103
Arizona Game and Fish Department (AZGFD), 27, 36, 52, 64, 67, 98, 118, 119
aspen, 27–31, 43, 45, 48, 49–52, 57, 85, 97, 124, 126, 143, 149
Bear Wallow Wilderness, 83, 126, 127, 130
Blue Range Primitive Area, 71, 128–30
caves, 99, 100
climate change (also called climate variability), 16, 25, 28, 29, 51, 86, 124
coarse woody debris, 21, 28, 29, 34, 41, 43, 46, 47, 48, 49, 50, 52, 54, 56, 114, 117, 151
communication sites, 101–3, 134, 136, 151
conservation education, 65, 67, 77, 79, 80, 87–88, 90, 105, 120, 145
cultural resources, 16, 70, 76, 89–92, 97, 98, 99
sacred site, 76, 78, 90, 93, 100, 135, 139
Traditional Cultural Property (TCP), 90, 93, 94, 100, 169
dry mixed conifer, 27–31, 42–45, 46, 51, 113
endangered species. *See* federally listed species
Endangered Species Act (ESA), 61, 152
energy corridor, 94, 101–3, 116–17, 134, 154
energy development, 101–3, 134, 161
Escudilla Wilderness, 80, 83, 126, 127, 130
Federal agencies
Bureau of Land Management (BLM), 89, 118, 157
Federal Highway Administration (FHA), 77, 79
Natural Resource Conservation Service (NRCS), 67
Federal agenices
Fish and Wildlife Service (USFWS), 36
federally listed species, 17, 27, 60–65, 143, 152, 154
fire management, 39, 112, 127, 130
community wildfire protection plan, 31, 112, 114, 144, 151
fire behavior, 28
fire regime, 17, 18, 28, 30, 37, 39, 40, 41, 43, 44, 45, 46, 47, 48, 49, 50, 53, 54, 55, 56, 58, 59, 60, 66, 113, 135, 155
planned ignition (also called prescribed fire), 18, 35, 39, 114, 128, 131, 161
unplanned ignition (also called wildfire), 18, 33, 38, 113, 114, 169
forest health, 39, 143
even-aged management, 38, 39, 95, 154
restoration, 16, 30, 36, 52, 59, 120, 121, 122, 143, 153
uneven-aged management, 38, 39, 95, 169
forest product, 12, 29, 36, 37, 39, 93, 94–96, 103, 112, 135–37, 145, 169
biomass, 94–96, 136, 145, 171
Christmas tree, 94–96, 145
fuelwood, 94–96, 95, 135, 136, 145, 155
timber, 8, 94–96, 112, 124, 135–37, 144, 168
Fort Apache Indian Reservation. See White Mountain Apache Tribe
grasslands, 56–59, 85, 113, 136, 143
Great Basin, 27–31, 40, 55, 56–59, 57
montane/subalpine, 11, 27–31, 40, 56–59
semi-desert, 27–31, 53, 56–59, 124
grazing. *See* livestock grazing
Hydrologic Unit Code (HUC). *See* watershed
interior chaparral, 27–31, 56, 59–60, 136
invasive species, 16, 25, 59, 65–67, 77, 101, 103, 115, 117, 122, 124, 143, 144, 157, 189
Inventoried Roadless Areas (IRAs), 70, 121
lands, 88–89
livestock grazing, 22, 23, 36, 86, 96–98, 122, 124, 126, 128, 133–34, 151, 158
Madrean pine-oak, 27–31, 52–53, 53–54, 56, 59
Management Areas, 133–34, 134–35, 135–37, 137–39, 67
Community-Forest Intermix, 38, 102, 111, 112–15, 117
Energy Corridor, 111, 116–17
General Forest, 102, 111, 112
High Use Developed Recreation Area, 111, 115–16
Natural Landscape, 83, 111, 121–22, 129
Primitive Area, 83, 100, 102, 111, 128–30
Recommended Research Natural Area, 111, 123–25
Recommended Wilderness, 102, 111, 130–31
Research Natural Area, 111, 122–25
Wild Horse Territory, 100, 111, 118–19
Wilderness, 100, 102, 111, 126–28
Wildlife Quiet Area, 102, 111, 119–20
mechanized travel, 81, 126, 139, 158
minerals and geology, 36, 93, 98–101, 129, 151, 157, 158, 166
mining, 94, 98–101, 128, 158
Mogollon Rim, 11, 12, 56, 80, 85, 129
motorized opportunities, 71–73, 75–77, 84, 100, 115, 116, 121, 126, 137–39, 159
Mount Baldy Wilderness, 18, 19, 83, 122, 123, 124, 126, 127, 142
National Environmental Policy Act (NEPA), 124, 130, 142, 143, 145
National Forest Management Act (NFMA), 1, 5, 135
National recreation trail, 7, 80–81, 81, 126

non-motorized opportunities, 71–73, 78–79, 81, 84, 112, 116, 118, 119–20, 121, 123, 125, 126–28, 128–30, 129, 130–31, 131, 67, 160
off-highway vehicles (OHVs), 12, 69, 75–77, 94, 137–39, 144
old growth, 29, 38, 54, 124, 160
Phelps Cabin Botanical Area, 102, 122, 124, 125
Phelps Cabin Research Natural Area, 102, 122
piñon-juniper, 27–31, 43, 52–53, 55–56, 57, 113
plan consistency, 5
plan decisions, 5–8, 141
ponderosa pine, 11, 27–31, 40–42, 43, 45, 50, 51, 80, 113
rare plants, 16, 60–65
recreational opportunities, 22, 69–71, 75–77, 86, 89, 104, 112, 113, 119, 123, 137–39, 67, 144
  developed recreation, 12, 67, 70, 73, 79, 115–16, 136, 152
  dispersed recreation, 12, 70, 71–73, 120, 152
  winter recreation, 12, 69, 72, 120, 140
research natural area, 7, 99, 100, 122–25, 123–25, 164
revision topics, 3
riparian, 11, 22–24, 25–27, 27–31, 31–36, 89, 97, 98, 104, 113, 117, 124, 136, 142, 164
roads and trails, 23, 24, 27, 65, 75–77, 78–79, 81, 86, 98, 99, 103, 112, 115, 117, 119, 121, 123, 126, 127, 129, 137–39, 144, 168
  motor vehic le use map (MVUM), 137
  motor vehicle use map (MVUM), 77
  National Forest System roads and trails, 35, 75, 138, 159
  unauthorized roads and trails, 21, 35, 59, 75, 127, 169
Rodeo-Chediski Fire, 16, 106
scale, 15, 28, 165
scenic byway, 7, 12, 77, 79–80, 115
scenic resources, 58, 73, 77, 79–80, 81, 84–86, 99, 101, 104, 112, 113, 117, 118, 121, 123, 125, 127, 129, 130, 144, 165
sensitive species, 125, 143
soil resources, 18, 20–22, 22–24, 27–31, 34, 136, 142, 167
special uses, 101–3, 134–35
spruce-fir, 27–31, 47–49, 51, 113, 120, 124
Terrestrial Ecosystem Survey (TES), 31, 53, 168
timber production. *See* forest product
Travel Management Rule, 77
uneven-aged management. *See* forest health
Wallow Fire, 5, 16, 20, 40, 43, 45, 48, 106
water resources, 22–24, 82–84
  water rights, 22, 23, 22–24, 105, 149, 154
  water uses, 102, 103–5, 22–24
watershed, 17, 22–24, 25–27, 112, 142, 157
  Hydrologic Unit Code (HUC) watershed, 15, 17, 21, 26, 31, 39, 105, 112, 157, 162, 165
wet mixed conifer, 27–31, 45–47, 51, 113, 124
White Mountain Apache Tribe, 93
  Fort Apache Indian Reservation, 126
White Mountains, 1, 12, 86
wild and scenic river, 12, 82–84, 100, 102, 125, 136, 170
wilderness. *See* Management Areas
wildland-urban interface (WUI), 86, 112, 120, 151
wildlife, 12, 16, 17, 22, 28, 29, 32, 39, 53, 54, 57, 60–65, 70, 72, 74, 75, 89, 95, 97, 98, 102, 104, 119–20, 119, 121, 126, 127, 129, 130
  aquatic species, 18, 23, 25–27, 31–36, 32, 36, 67, 76, 78, 124
  bald eagle, 63
  connectivity, 23, 32, 62, 76, 78, 129, 151
  fish, 12, 16, 22, 23, 25–27, 31–36, 32, 36, 75, 77, 104
  Gunnison's prairie dog, 63, 64
  Mexican gray wolf, 12, 61
  Mexican spotted owl, 27, 54, 76, 120, 124, 136
  Northern goshawk, 41, 42, 44, 47, 49, 63, 76, 120, 156